A Retrospective and Prospective Analysis of Functional Outcome of Open reduction internal fixation of acetabular fixatures treated through Modified Rives-Stoppa's approach

Dissertation submitted to

M.S. DEGREE-BRANCH II
ORTHOPAEDIC SURGERY

THE TAMILNADU DR. M. G. R. MEDICAL UNIVERSITY
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CERTIFICATE

This is to certify that this dissertation titled **"A Retrospective and Prospective Analysis of Functional Outcome of Open reduction Internal fixation of acetabular fixatures treated through Modified Rives-Stoppa's approach"** is a bonafide record of work done by **DR.M.SURESH KUMAR ,** during the period of his Post graduate study from May 2012 to September 2014 under guidance and supervision in the INSTITUTE OF ORTHOPAEDICS AND TRAUMATOLOGY, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai-600003, in partial fulfilment of the requirement for **M.S.ORTHOPAEDIC SURGERY** degree Examination of The Tamilnadu Dr. M.G.R. Medical University to be held in April 2015.

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DECLARATION

I declare that the dissertation entitled **"A Retrospective and Prospective Analysis of Functional Outcome of Open reduction internal fixation of acetabular fixatures treated through Modified Rives-Stoppa's approach "** Submitted by me for the degree of M.S is the record work carried out by me during the period of May 2012 to September 2014 under the guidance of **Prof**.**V.Singaravadivelu.M.S.Ortho.,D.Ortho.,**. Professor of Orthopaedics, Institute of Orthopaedics and Traumatology, Madras MedicalCollege, Chennai. This dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai, in partial fulfilment of the University regulations for the award of degree of M.S.ORTHOPAEDICS
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Date:

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CONTENTS

ABSTRACT

ANALYSIS OF CLINICAL OUTCOME OF ACETABULAR FRACTURES TREATED THROUGH MODIFIED RIVES - STOPPA'S APPROACH

Acetabular fractures are increasing now a days due to non awareness of safety in automobile. Most common injuries are due to road traffic accidents. It is a high velocity injury. In this study we analysed the clinical outcome of Acetabular fracture treated through Modified Rives – Stoppa's approach. This approach has less complications, as neuro vascular window and inguinal canal is not breached here. We analysed the outcome using merle D' Aubigne score. We analaysed 10 cases out of 10 cases, 2 had excellent outcome 4 had good outcome and 3 had fair outcome. No poor outcome were encountered during our study we had a complication of DVT in 1 case which resolved after treatment through this approach, we are able to produce satisfactory outcome in acetabular fractures.

Keywords : Acetabulam, Rives – Stoppa, Merle D' Aubigne

Introduction

Over the last 20 years, Improvements in automobile safety, prehospital care, resuscitation, and transport as well as standardized protocols for treatment have all contributed to improved survival after the severe pelvic injuries-.Only 10% of the pelvic disruptions involve the acetabulum. The primary cause in younger individuals is high-energy trauma. Acetabular fractures generally occur in conjunction with other fractures.

Posterior wall fractures are most common, comprising 24% of acetabular fractures.

The treatment of acetabular fractures is a complex area of orthopaedics that is being continually refined. It involves a definite learning curve.

Acetabular fractures are generally associated with other injuries of the pelvis and/or lower limbs which may influence treatment options, surgical approach and clinical outcomes. Patient age, fracture stability, the presence of

comorbidities and osteoporosis, combined with surgeon experience also influence treatment options.

The goals of the treatment should be anatomic reconstruction of articular surface and early mobilization. This goal can be achieved only when acetabulum is adequately exposed and rigid internal fixation is done. Surgical approaches routinely used for operative management through anterior approach are Ilioinguinal and extended iliofemoral or triradiate approaches or combinations of them.

Displaced fractures of the pelvis that involve the acetabulum are difficult to treat. With closed methods, it is difficult, if not impossible, to restore the articular surfaces completely or to obtain sufficient stability for early motion of the hip.

The treatment of simple fractures of acetabulum is well known and studied. Treatment of complex Acetabular fracture is difficult as it involves extensive exposure and difficult to reduce the columns and walls in a single approach.

The purpose of this study is to analyse the results and functional outcome of open reduction and internal fixation of fractures of acetabulum which needs anterior fixation with use of Modified Rives-Stoppa's approach

According to Judet and Letournal fractures of the acetabulam[13] were classified as

ELEMENTARY TYPES

- Posterior Wall,
- Posterior column,
- Anterior wall,
- Anterior column and
- Transverse fractures.

ASSOCIATED TYPES

- Transverse fracture
- Transverse with posterior wall fracture
- T type fracture
- Anterior wall or column with posterior hemitransverse
- Both column fracture

AIM OF THE STUDTY

The aim of this study is to analyse the Clinical Outcome of Internal Fixation of Fractures of Acetabulum through Modified Rives-Stoppa's Approach.

Review of literature

Historically, this was a relatively uncommon injury. The severity of these injuries is demonstrated by the fact that early descriptions of acetabular fractures are the result of autopsy findings of patients who had sustained significant trauma[16].

In 1821, Cooper reported the first detailed description of an acetabular fracture. This case described autopsy findings in a patient with an associated central dislocation of the femoral head into the pelvis

In 1909, Schroeder reported detailed compendium of the first 49 cases reported in the literature.The majority of these are reports of autopsy findings in patients who died of complications related to hemorrhagic shock or the late onset of intra-abdominal sepsis.

In 1911, Skillern reported an additional four cases of fracture of the “floor” of the acetabulum. Early literature refers to fractures through the area of the cotyloid or acetabular fossa below the roof, either anteriorly or posterioly, as fractures of the floor of the acetabulum.

Throughout most of the 20th Century, there was little uniformity in terminology, classification and description, and treatment of these injuries .In 1926, MacGuire described the lateral traction and treatment via a percutaneously placed threaded pin into the proximal femur. Approximately three months of immobilization was recommended at that time.

Campbell reported on the treatment of posterior dislocation of the hip with acetabular fractures in 1936. He noted that fracture of the acetabulum was relatively common with dislocation of the hip[13].

In the early 1940s, Levine reported the early successful results of ORIF of a central fracture of the acetabulum

In the 1950s, Thompson and Epstein published their classification of hip dislocation and fracture dislocation.

Knight and Smith described operative reduction of “central dislocation of the acetabulum”. These authors described fractures as vertical (i.e., column-type fracture) or horizontal (i.e., transverse-type fracture pattern).Knight and Smith advocated restoration of the “weight-bearing vault” of the acetabulum. They also advocated an anterior (iliofemoral) approach for horizontal fractures and a posterior approach for the vertical fracture types, which in their series were largely posterior column injuries.

In 1962, Brav described a series of 523 patients with hip dislocations and fracture dislocations with follow-up on 264 of these patients in two years

In 1961, Rowe and Lowell published their landmark article entitled “Prognosis of Fractures of the Acetabulum”. This is a retrospective study of 93 acetabular fractures in 90 patients, all with a minimum of one-year follow-up They described a view with the patient placed prone, with the uninjured hip rotated to 60 degree to evaluate for a posterior acetabular fracture.

In 1964, Judet et al. published their now classic article entitled “Fractures of the Acetabulum, Classification and Surgical Approaches for Open Reduction”. This manuscript describes the use of the AP and two 45* oblique views of the pelvis to evaluate the acetabular fractures. These radiographic views, now known as “Judet”

views, named after the author; include the AP pelvis, the obturator view, and the iliac oblique view. These are now the standard radiographic films used for evaluation of acetabular fractures. This article represented a substantial step forward in the understanding of acetabular anatomy and fracture classifications.

The 1980s saw substantial developments in the treatment of acetabular fractures. Computed tomography was introduced in the 1980s and was widely championed by Mears and others

In 1984, Letournel held his first international course on treatment of fractures of the pelvis and acetabulum in Paris

In 1986, Matta published two articles that helped establish the modern basis of nonoperative treatment of acetabular fractures .Using the AP and the 45* oblique Judet views of the pelvis, Matta developed the concept of a “roof arc measurement”.

Letournel advocated an approach or protocol to treatment of acetabular fractures that includes extensive study of the X-rays to understand the anatomy of the fracture pattern and subsequent correct classification followed by appropriate operative positioning of the patient whenever possible to operate the fracture through a single surgical approach. Emphasis has been placed on obtaining an anatomic reduction of

the articular surface. Long-term clinical outcome data suggest that the more accurate the articular reduction more is the clinical outcome.

Other authors have advocated protocols with multiple approaches, either simultaneously or consecutively, as a routine approach for certain types of acetabular fractures.

In 1990s, Cole and Hirvensalo described an approach independently discovered a new approach through a midline intrapelvic dissection for pelvis and anterior column. It was a modification of an approach used for bilateral inguinal hernias by Rives and Stoppa.

Applied anatomy

The coalescence of the three bones, the ilium, ischium, and pubis, join to each other centrally to form the cotyloid or acetabular cavity.It is useful for the surgeon to divide the acetabulum and innominat bone into anterior and posterior columns.

The Anterior column comprises of

Anterior border of the iliac wing,

Pelvic brim,

Anterior wall of the acetabulum, and

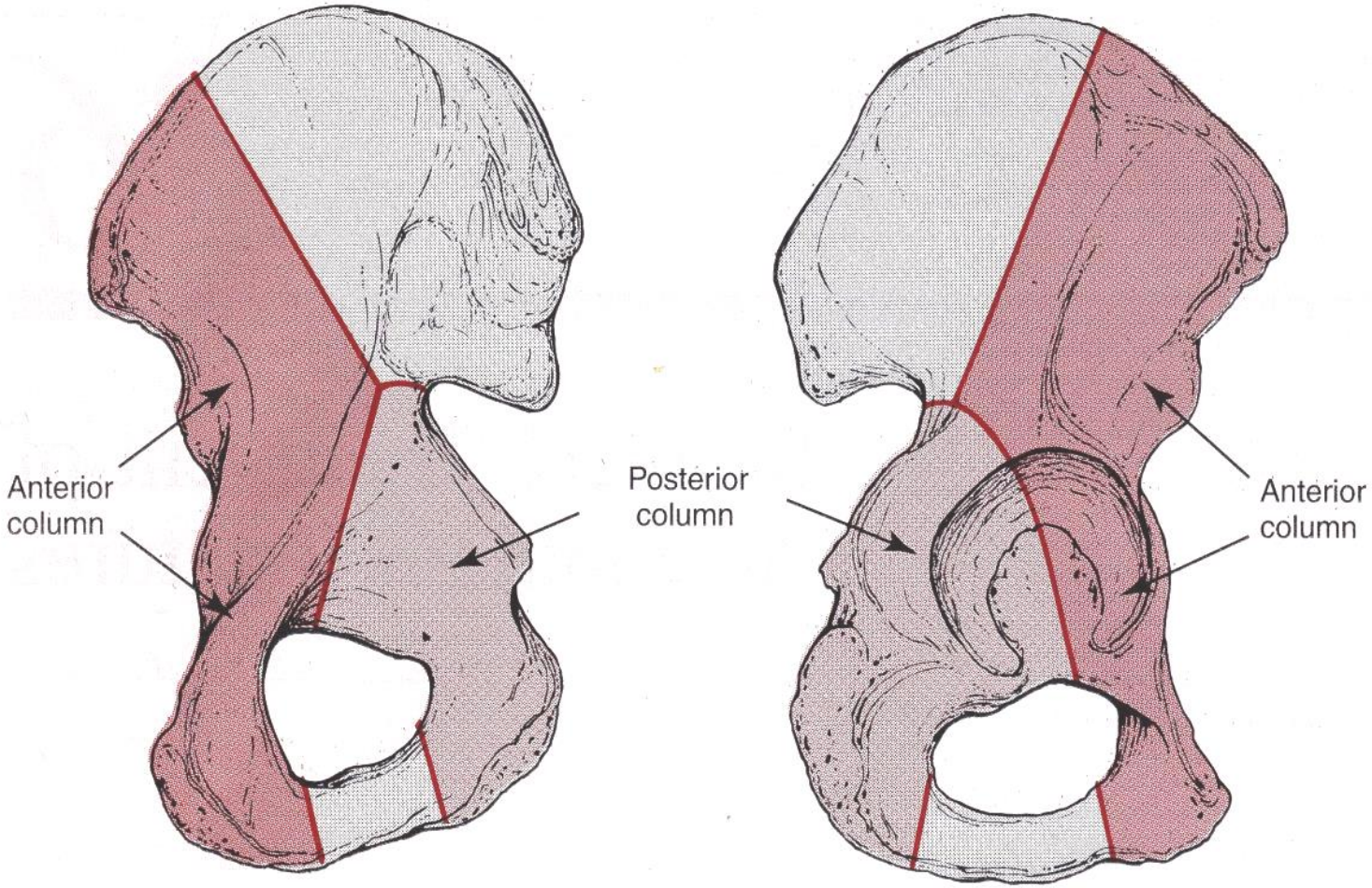
Superior pubic ramus

The Posterior column comprises of

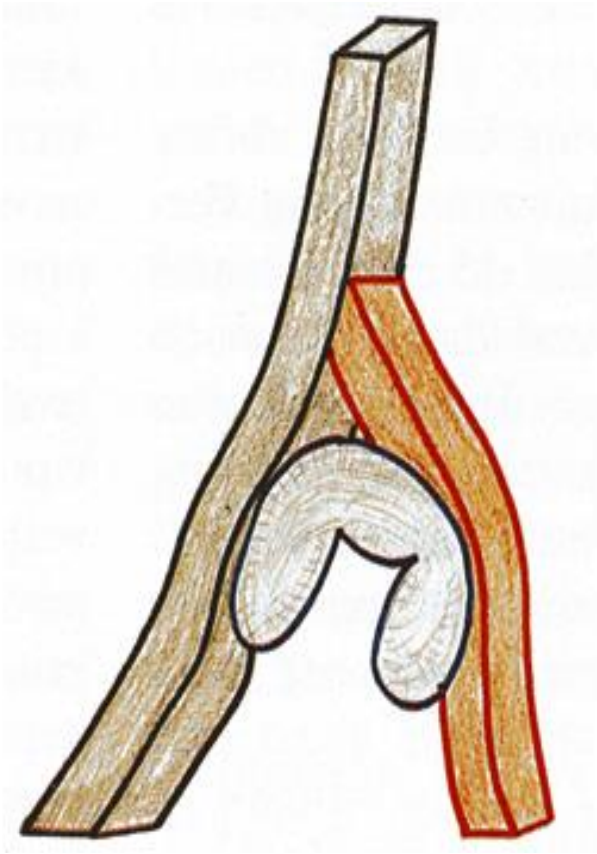
Ischial portion of the bone, including the greater and lesser sciatic notch,

Posterior wall of the acetabulum, and

Ischial tuberosity.


Anterior column
Posterior column
Anterior column

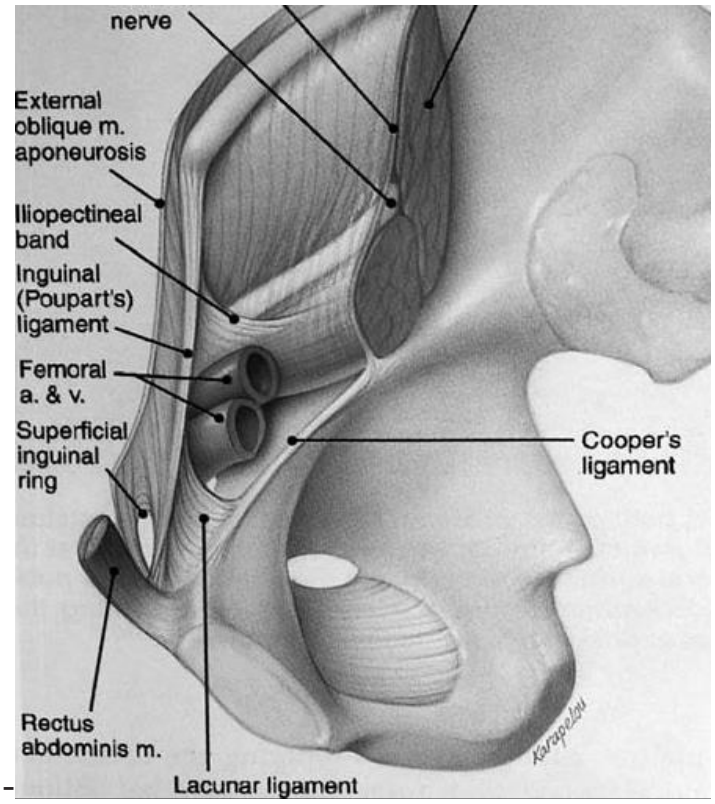
The two columns forms a inverted **Y** shape



Vascular anatomy:

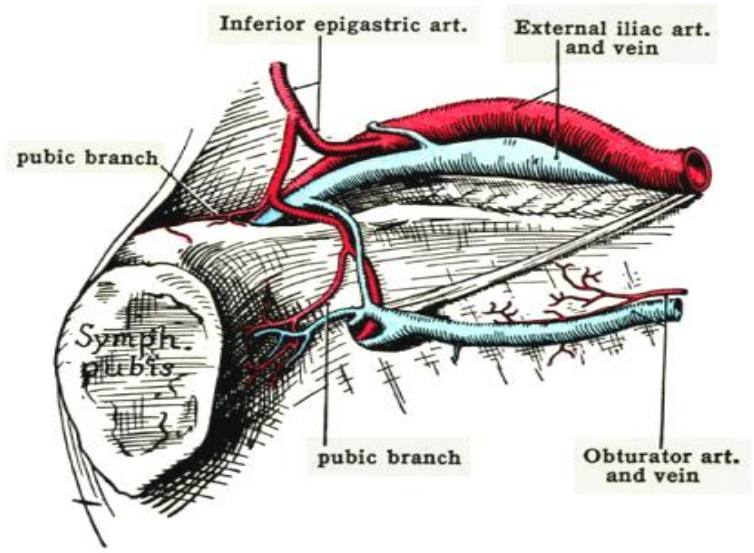
Anterior exposure:

External iliac vessels form main form of concern. It divides the medial and middle window.



Obturator Artery

- Originates from the internal iliac artery (70%)
- Small caliber anastomoses between the obturator and external iliac systems are common
- The pubic branch of the obturator artery commonly anastomoses behind the body of the pubis with the pubic branch of the inferior epigastric artery
- In a small percentage of cases this anomalous vessel is of large caliber and can result in severe bleeding if it is unknowingly lacerated.This is the so-called Corona Mortis



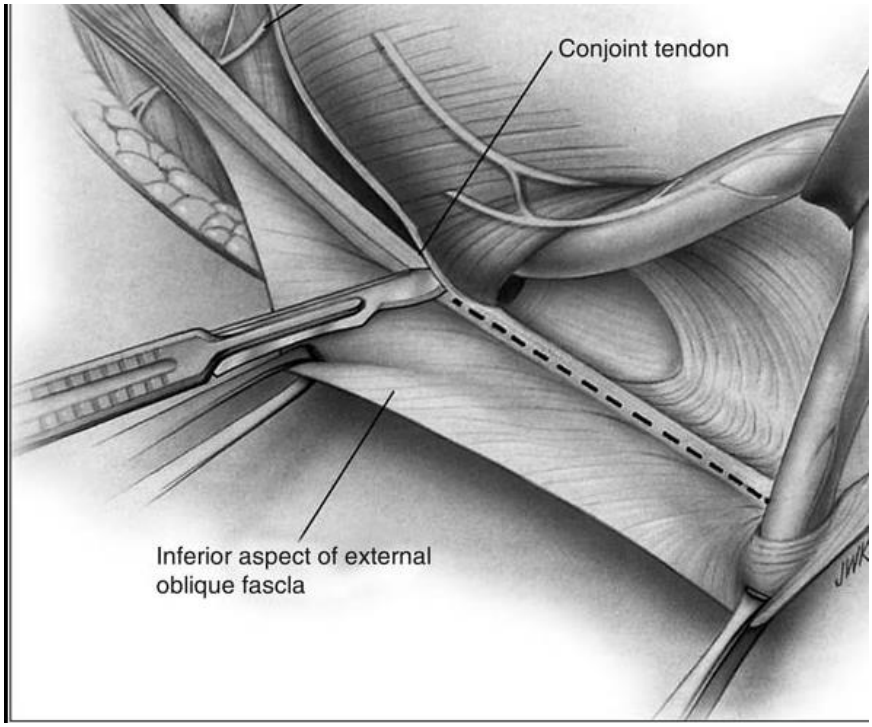
Abnormal [Accessory]

–

Anterior exposure:

Lateral cutaneous nerve: The lateral cutaneous nerve of the thigh will almost certainly have to be divided around the anterior superior iliac spine at this stage of dissection

Femoral nerve: The femoral nerve runs beneath the inguinal canal lying on the iliopsoas muscle. Vigorous retraction has to be avoided, as stretching the nerve will result in a paralysis of the quadriceps muscle.



Other structures :

The spermatic cord contains the vas deferens and testicular artery. Although it is easily mobilized, it must be treated gently during the approach and the closure to avoid ischemic damage to the testicle.

The bladder is easily mobilized off the back of the symphysis pubis. Fractures involving the lower half of the anterior column may have caused bladder damage and adhesions.

Mechanism of injury

Acetabular fractures occur as force is transmitted from the femur to the pelvis via the femoral head.

The fracture pattern, therefore, is dependent on the

- Position of the hip at the time of injury,
- Direction and
- Magnitude of the impact.

The magnitude of displacement as well as the comminution or degree of articular impaction depends on the magnitude of the force applied as well as the

strength of the bone it is applied to. A relatively low-energy injury may produce a severely comminuted fracture in an osteoporotic patient.

Force applied and fracture pattern:

FORCE	Hip Abduction	Hip Rotation	Fracture pattern
Along the femoral neck	Neutral	Neutral	Anterior column with posterior hemitransverse
	Neutral	25*ER	Anterior column
	Neutral	50*ER	Anterior wall
	Neutral	20*IR	T shaped
	Neutral	50*IR	Posterior column
	Adduction	20*IR	Transtectal transverse
	Abduction	20*IR	Juxta/ infratectal transverse
Along the femoral shaft Hip flexed 90*	Neutral	Any	Posterior wall
	Abduction	Any	Transverse with posterior wall
	Adduction	Any	Posterior dislocation
Along the femoral shaft Hip extended	Neutral	Any	Posterosuperior wall fracture
	Abduction	Any	Transtectal transverse

ER-External Rotation

IR-Internal Rotation

Fracture classification

Classification of acetabular fractures is important in understanding the injury and is the key for surgical planning. The choice of surgical approach and the alternative fixation techniques available require full appreciation of the fracture anatomy.

Letournel and Judet's anatomical classification is divided into two broad groups: Elementary and Associated fractures, with five patterns in each.

JUDET AND LETOURNEL CLASSIFICATION[13]

ELEMENTARY TYPES

Posterior Wall,

Posterior column,

Anterior wall,

Anterior column and

Transverse fractures.

ASSOCIATED FRACTURE TYPES

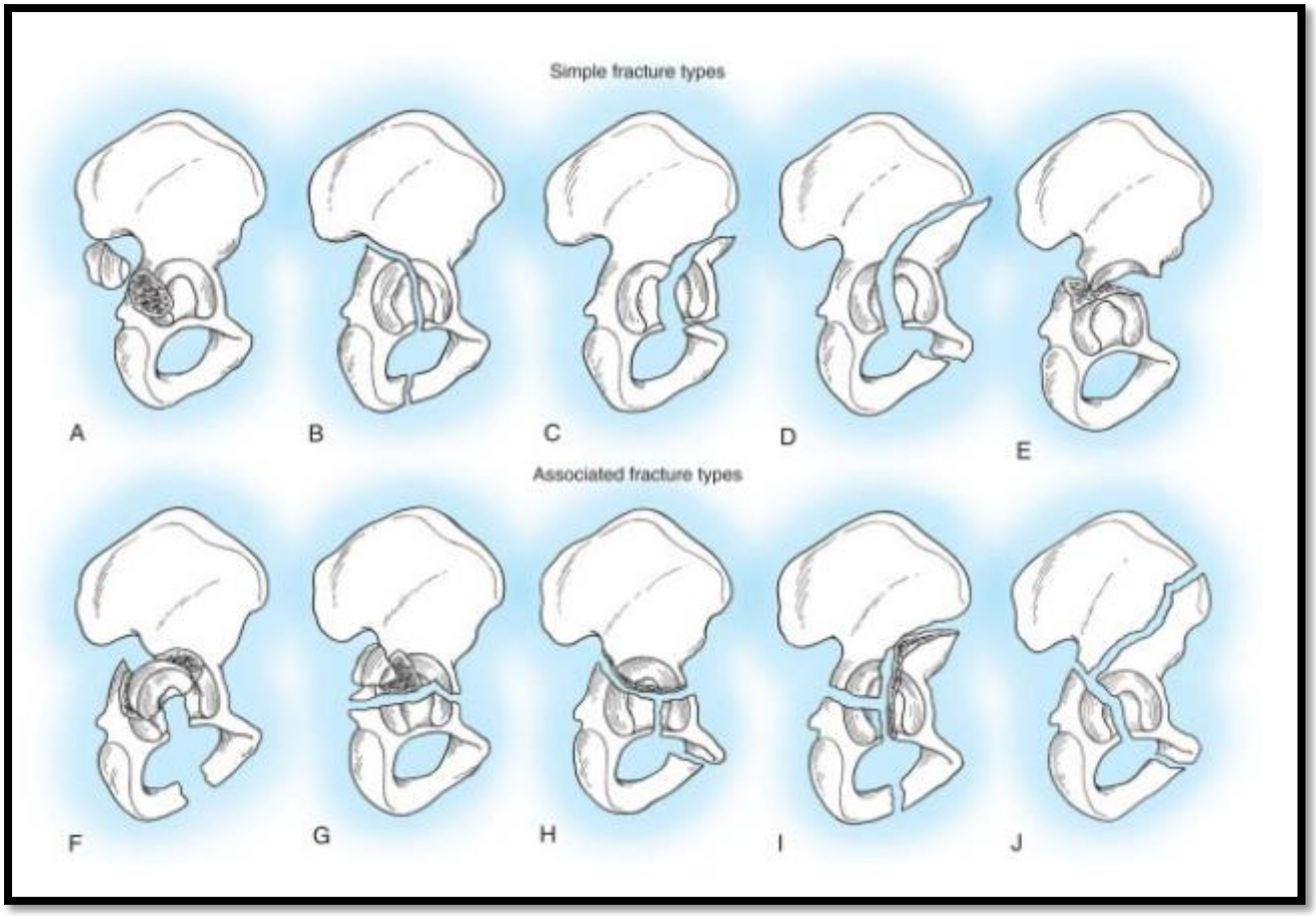
T type fractures,

Combined fractures of the posterior column and wall,

Combined Transverse And Posterior Wall Fractures,

Anterior column fractures with a hemitransverse posterior fracture, and

Both-column fractures.



LETOURNEL AND JUDET CLASSIFICATION

Tile described a modification of Letournel's classification .This modification enables these complex fracture patterns to be categorized into the A, B, and C types of the comprehensive classification of fractures developed by the Arbeitsgemeinschaft Fu¨r Osteosynthesefragen. The goal of this modification is

to *"allow surgeons to speak the same language"* and to aid in determining prognosis.

Comprehensive Classification: Acetabular Fractures

Type A: Partial articular fractures, one column

A1 Posterior wall fracture

A2 Posterior column fracture

A3 Anterior wall or anterior column fracture

Type B: Partial articular fractures, transverse

B1 Transverse fracture

B2 T-shaped fracture

B3 Anterior column and posterior hemitransverse fracture

Type C: Complete articular fractures, both columns

C1 High

C2 Low

C3 Involving sacroiliac joint

Comprehensive Classification: Articular Surface Modifiers

a: Femoral head subluxation

a1 Femoral head subluxation, anterior

a2 Femoral head subluxation, medial

a3 Femoral head subluxation, posterior

§: Femoral head dislocation

§1 Femoral head dislocation, anterior

§2 Femoral head dislocation, medial

§3 Femoral head dislocation, posterior

x: Acetabular surface

x1 Acetabular surface, chondral lesion

x2 Acetabular surface, impacted

d: Femoral head surface

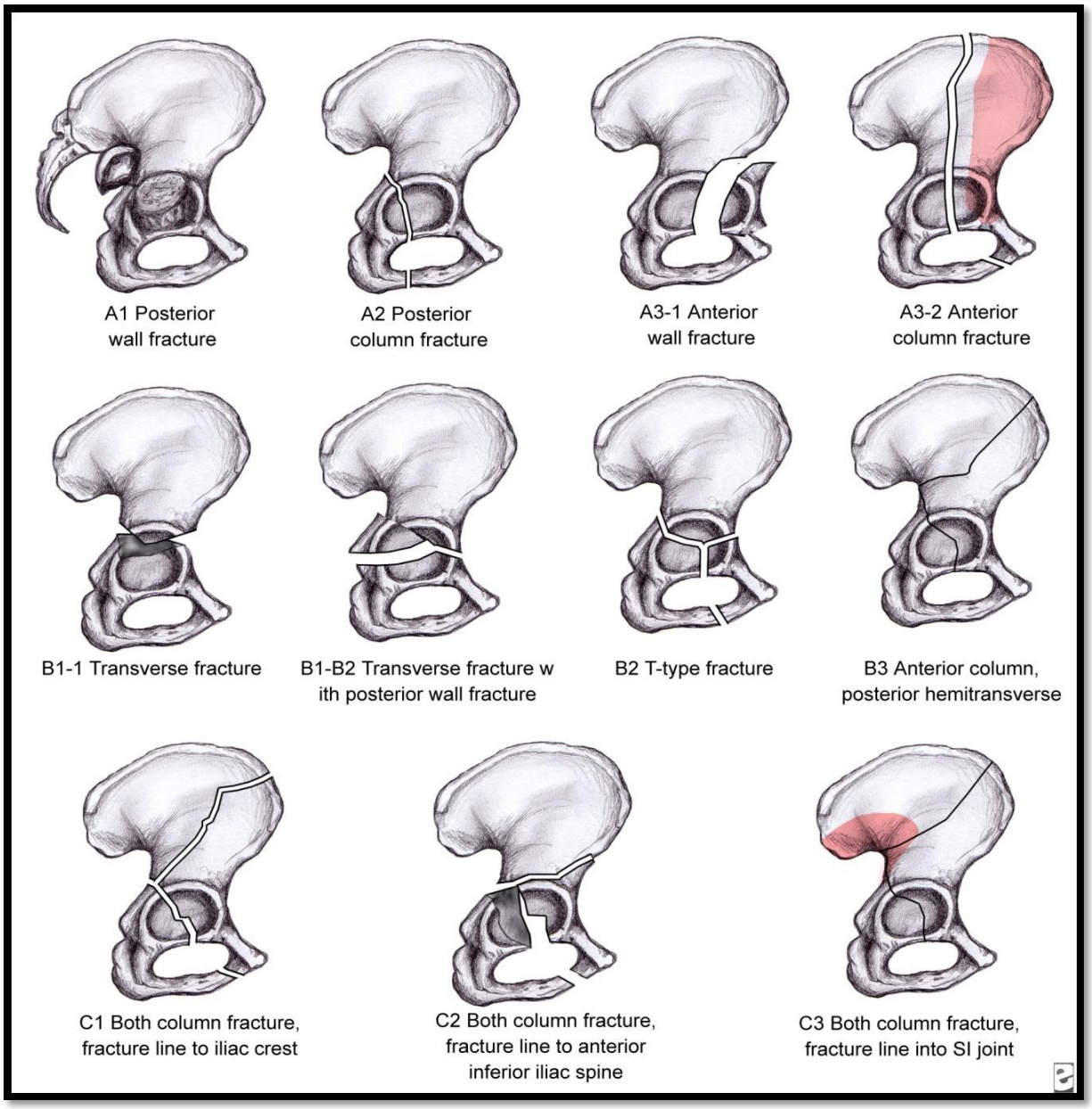
d1 Femoral head surface, chondral lesion

d2 Femoral head surface, impacted

d3 Femoral head surface, osteochondral fracture

e1 Intra-articular fragment requiring surgical removal

ø1 Nondisplaced fracture of the acetabulum



Ao Classification

Clinicoradiological assesment

Though life-threatening 25aemorrhage is rare in acetabular fractures without a simultaneous pelvic ring injury, any hemodynamically unstable patient must be investigated and treated aggressively under the ATLS guidelines.

General assessment including a rapid primary survey of Airway, bleeding, status of CNS, followed by hemodynamic resuscitation if patient is in shock. Secondary survey has to be done in detail that includes a thorough skeletal examination, examination of abdomen and pelvis and CNS.

History is important as the mode of injury gives the magnitude of force and its direction on which the pattern, displacement and communition of fracture depends.

Physical examinations include thorough inspection for external injuries, wounds, contusions and bruises. Special attention must be given to look for morel levelle lesion and bleeding per meatus. Attitude of the injured limb and its distal neurovascular status must be seen.

Rectal examination may show central dislocation as head can be palpated as a globular mass.

Radiological assessment:

Three views of acetabulum and CT Scan forms the standard protocol.

- Anteroposterior pelvis
- Judet views(Iliac oblique and Obturator oblique)
- CT scan of Pelvis with 3-D reconstruction

Anteroposterior pelvis

- This view shows

Iliopectineal line comprised of Anterior 3/4 corresponds to pelvic brim, and Posterior 1/4 corresponds to lower half of internal surface of the sciatic buttress and roof of greater sciatic notch,

Ilioischial line corresponds to quadrilateral surface,

Teardrop formed by

Internal limb – outer wall of obturator canal,

External limb –middle 1/3 of cotyloid fossa and Inferior border- ischiopubic notch

*Acetabular roof r*epresentative of the superior weight bearing area of the acetabulum

Anterior / posterior walls represent lateral extensions of articular surfaces

Associated pelvic ring injuries

Bilateral acetabular fractures

Femoral head fractures

Fracture displacement

Congruency of femoral head in acetabulum.

Judet Oblique Radiographs[12]

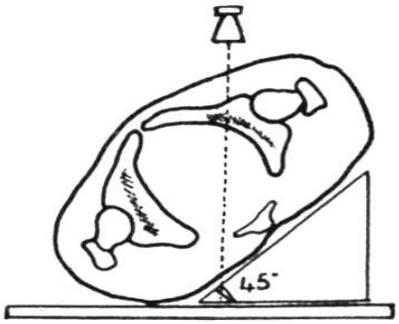
These are 45° oblique pelvic radiographs. It emphasize

acetabular columns. Coccyx tip should lie above the center of the femoral head to ensure adequate rotation

Obturator (Internal) Oblique[12]

This view is taken with injured side up. Coccyx centered over ipsilateral femoral head.

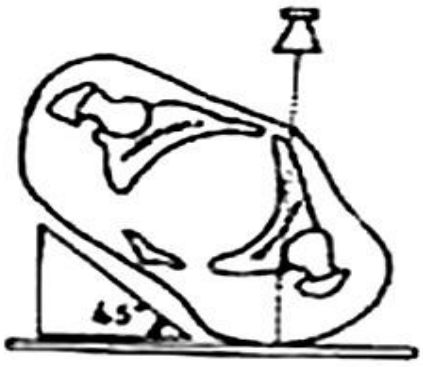
- Obturator foramen in profile
- Highlights pelvic brim, anterior column and posterior wall
- Assess congruency of femoral head in acetabulum.

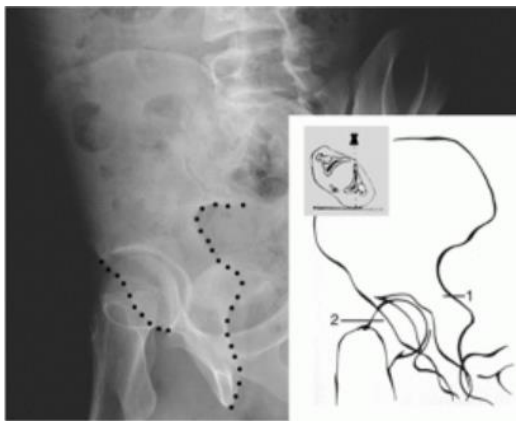


Iliac (External) Oblique[12]

This view is taken with injured side down.Coccyx centered over contralateral femoral head.

- Iliac wing in profile
- Highlights posterior column, anterior wall, posterior border of innominate bone and quadrilateral plate
- Assess congruency of femoral head in acetabulum .

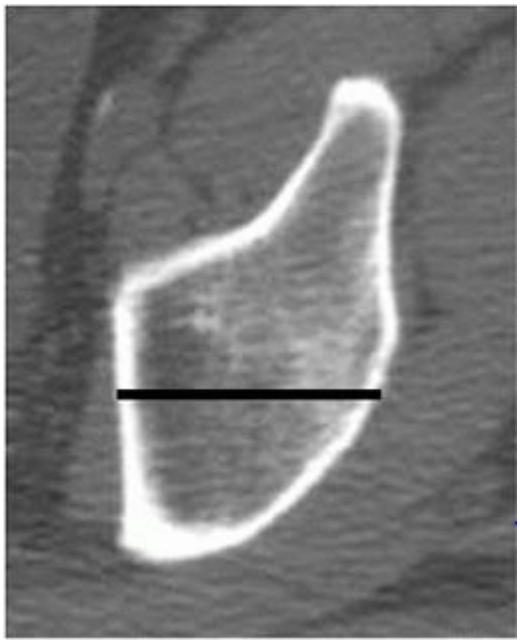




CT scan[13]

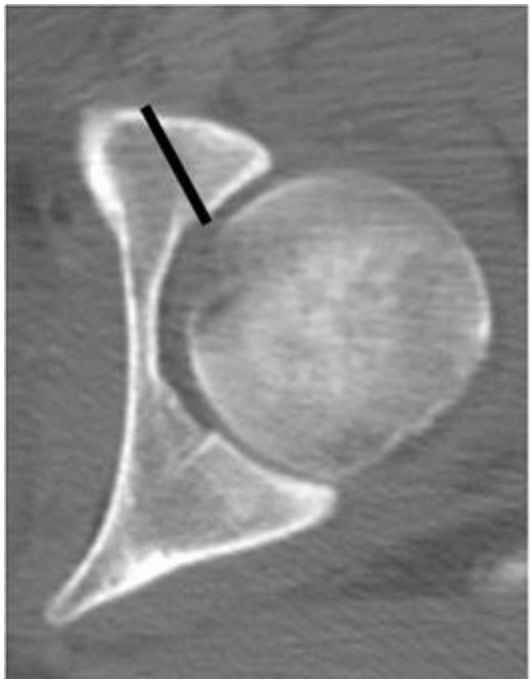
CT scan helps in identification of fracture lines not visualized by radiographs,orientation of fracture line,vertical portion of T-type acetabular fracture and rotation of fracture fragments.we can very well make out

- Acetabular wall fractures
- Intra-articular loose fragments
- Marginal impacted fragment
- Degree of fracture comminution
- Position of the femoral head
- Femoral head lesions
- Joint Congruence
- SIJ and the posterior pelvic ring

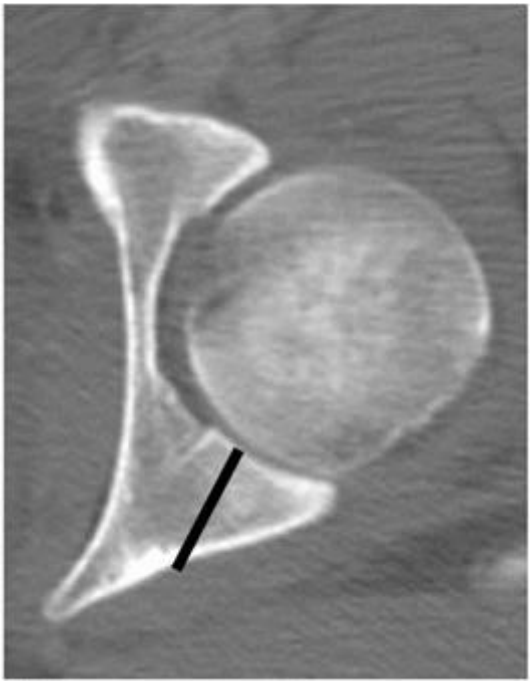


Fracture of one or both column

Transverse fracture of acetabulum



Anterior wall fracture



Posterior wall fracture

3-D CT scan

It is converted from 2 dimensional CT scan data.Image quality determined by software.Allows for subtraction of femur.Allows for rotation of pelvis provides a good overall picture of the *fracture configuration.*

Treatment protocol:

General assessment and resuscitation

Advanced trauma life support (ATLS) protocol to be followed for general assessment, resuscitation and identifying skeletal and associated injuries esp. vascular and nerve injuries of affected lower limb. After stabilising, the patient is assessed radiologically.

Radiological assessment was done with xray Anteroposterior, Judet views of acetabulum (Iliac oblique and Obturator oblique) and computed tomography with 3-d reconstruction of acetabulum.

Closed reduction was done in fracture dislocated patients under i.v sedation and lower skeletal traction was applied in all patients.

Time of surgery

Open reduction and internal fixation to be done within 21 days of injury.

Surgical exposure

Fracture pattern and type is defined using anteroposterior, judet views and computed tomography. Modified Rives-Stoppa's approach was used for anterior fractures .Initially single exposure, open reduction and internal fixation was done. Post operative X rays were taken and use of other was decided with fracture reduction.

Modified Rives-Stoppa's Approach:

This approach provides access to

- Pubic body,
- Superior pubic ramus
- Pubic root,
- Ilium above and below the pectineal lune,
- Quadrilateral plate,
- Medial aspect of the posterior column,
- Sciatic buttress, and
- Sacroiliac joint

The patient is placed in supine position on a flat radiolucent table.

Bladder is catheterised with Foley's catheter for baldder protection,

visualization and fluid balance assessment. The affected limb is draped with the hip and knee in flexion to aid in relaxing the Iliopsoas muscle and external iliac vessels and femoral neurovascular structures.

The surgical field shows the entire abdomen exposing the iliac crests above and palpable pubic bodies below.

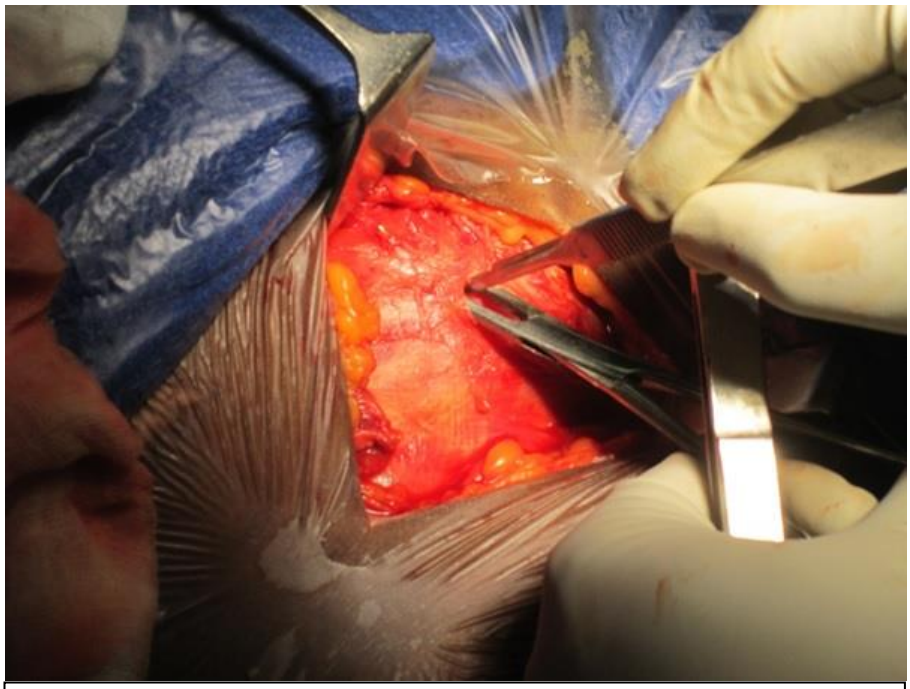
Prophylactic antibiotics are given half an hour before surgery. The surgeon is standing in the side opposite to the injured acetabulum with a lamp from Right side of the surgeon. A transverse curvilinear skin incision 1 to 2 fingerbreaths

above the pubic symphysis is made along the bikini line upto the anterior rectus fascia. Avoid dissection too far laterally as it risks of damaging the spermatic cord or round ligament which exit through superficial inguinal ring. Rectus abdominis muscle is split vertically along the crosslinked fibres of linea alba and the transversalis fascia is incised to enter into the retropubic space of

Retzius, which is then enhanced with finger dissection to push the bladder away from the surgical field and also from anterior pelvic ring.

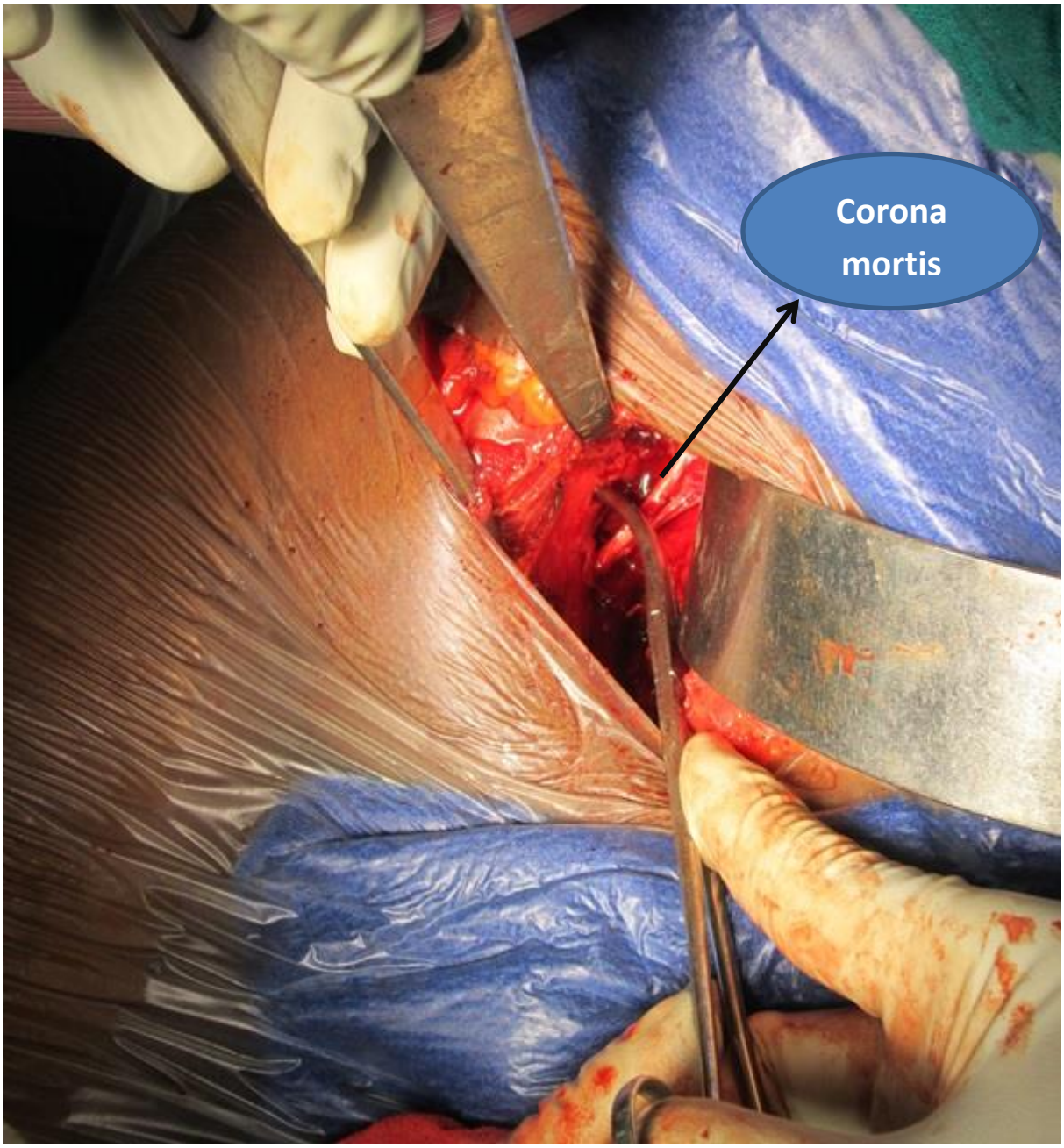
From now onwards the dissection lies in the extra peritoneal space between the true pelvis and false pelvis. The insertion of the rectus abdominus muscle in the anterior aspect of the pubic bodies is left undisturbed but is erased from the anterosuperior aspect of the pubic bodies, pubic tubercle, and superior

ramus. Releasing the periosteum and iliopectineal fascia facilitates further lateral dissection along the superior ramus and pubic root.



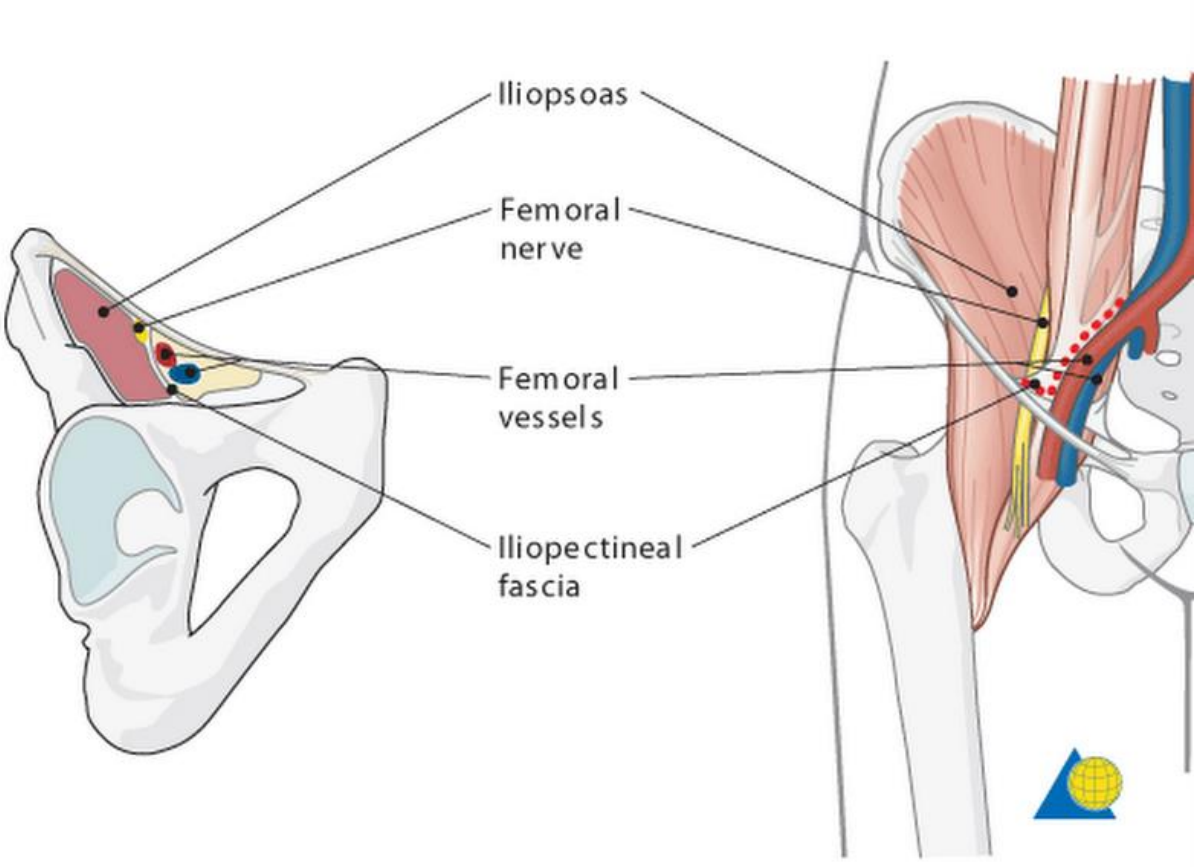
Splitting along the fibres of linea alba

Anastomoses between the external iliac and obturator vessels are visualized as they course over the Superior ramus toward the obturator foramen (corona mortis). Based on the size of these vessels it may be cauterized with diathermy, ligated with silk material, or clipped before erasing from the pubic root and pelvic brim.



Continue the incision along the periosteum and cut iliopectineal fascia which divides the muscular and vascular structures along the pelvic brim provides subperiosteal elevation of the iliopsoas. Now the anterior column and internal

iliac fossa will be exposed. Following the exposure of the internal iliac fossa and pelvic brim, quadrilateral surface and posterior column will be exposed.



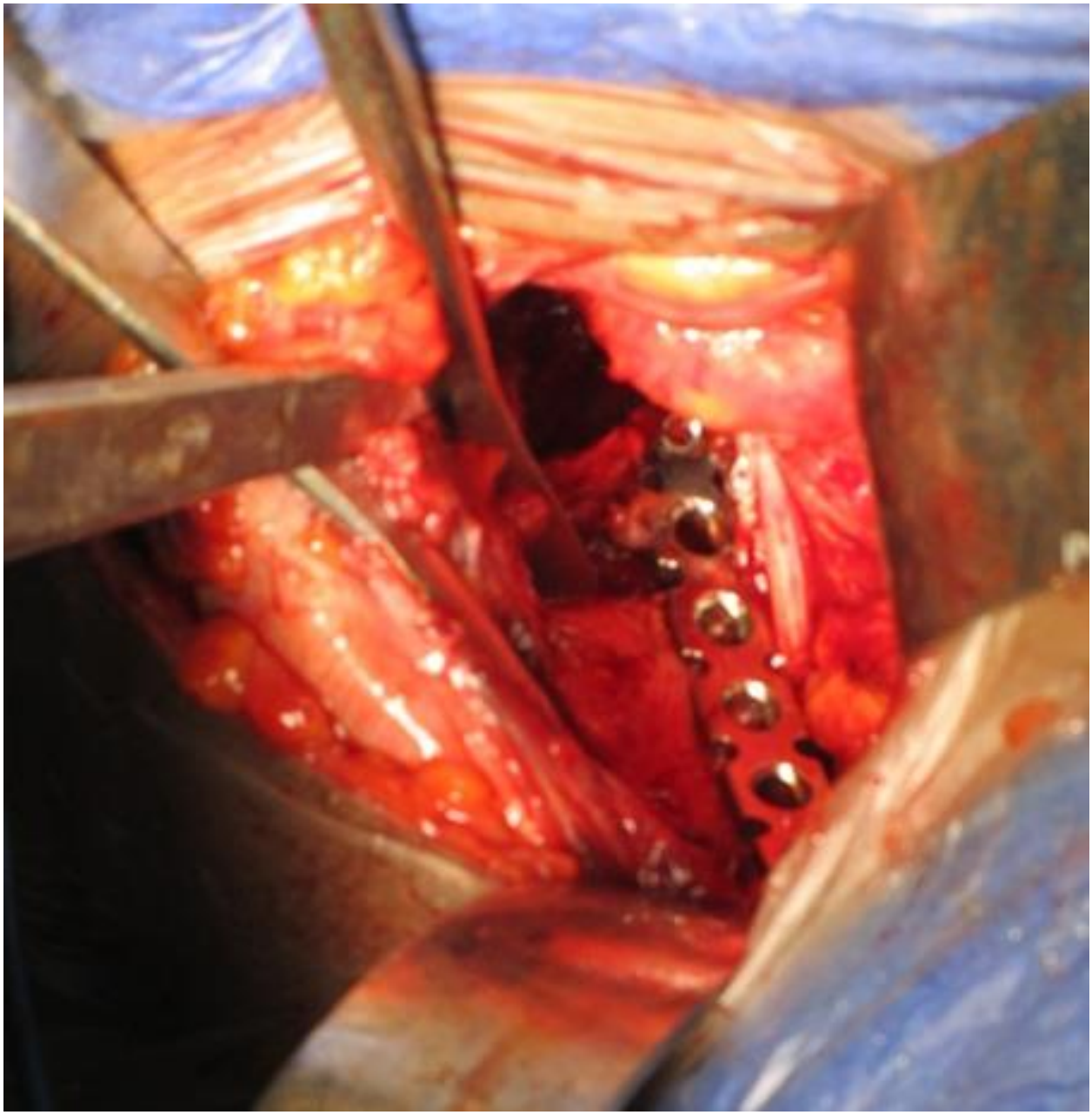
Lateral retraction of the femoral head enhances visualization of posterior column and quadrilateral surface which has been pushed medially and also releases tension on the obturator neurovascular structures. To deal with the fractures with a high anterior column component (exiting the iliac crest) or

those requiring placement of posterior column lag screws, a second incision along the iliac crest (lateral window) is used to facilitate reduction and placement of fixation. A second incision is made starting 2cm posterior to the anterior superior iliac spine along the crest posteriorly same as the incision used for bone grafting. The insertion of the external oblique muscle is incised which allows dissection over the crest into the internal iliac fossa. This will expose the iliacus muscle which is then elevated subperiosteally leads to the pelvic brim and anterior aspect of the sacroiliac joint.

Reduction techniques:

In anterior approach a farabeuf clamp or a schanz pin was placed in iliac crest to manipulate and reduce. Matta‘s Quadrangular clamp of various sizes and with offsets and Picador ball spike pusher are very important instruments in Acetabular surgery. Reduction was fixed with lag screws whenever possible. Lagging was done with 4mm cancellous screws or 3.5 mm cortical screw with washer. 3.5mm Reconstruction plates are used as neutralistion plate.

Plate contoured before placing



After placing the pre contoured plate over the anterior column

Post-operative protocol:

- All patients were given pre-operative antibiotics and post operatively for 5 - 7 days.
- Drain removal on 2nd post-operative day.
- Suture removal was done on post-operative day 12 to 14.
- Indomethecin[15] 25mg TDS was prescribed orally for 3 weeks.
- Mobilization was started 3 weeks after surgery.
- Weight bearing was started when fracture consolidated mostly on the 3rd or 4th month

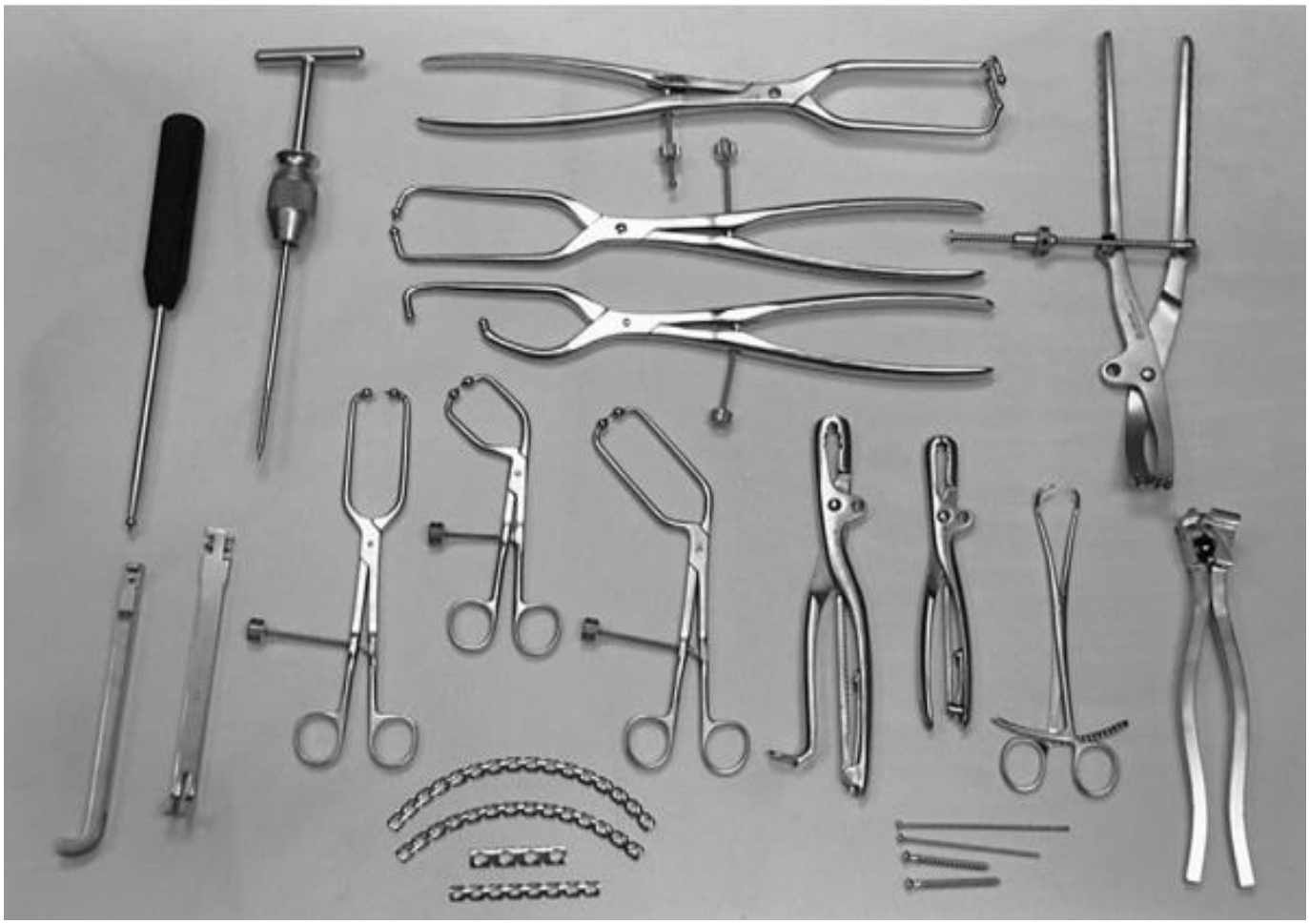
Radiological and functional examination was done on monthly review for first 6 months and third monthly thereafter.

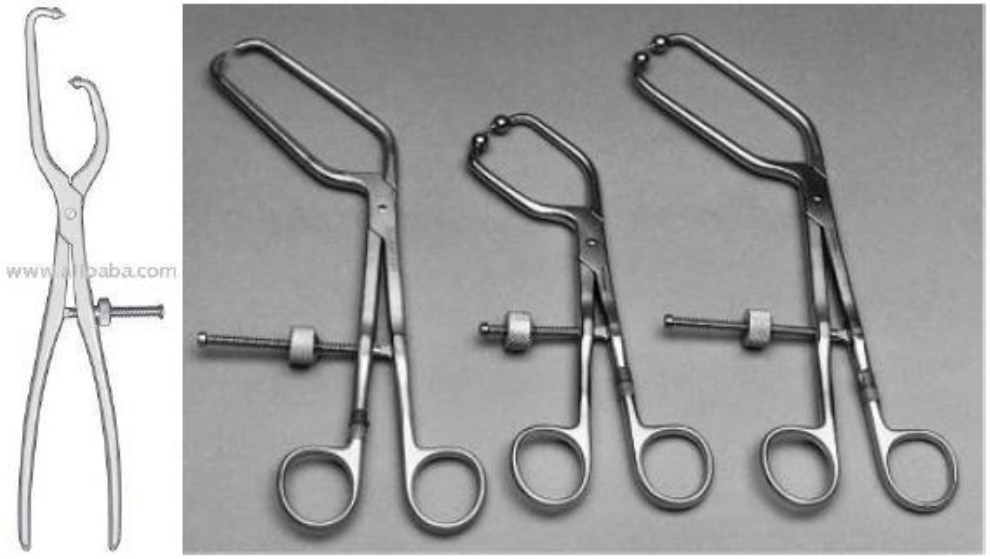
Analysis

Patients were analysed post operatively and Modified Merle d' Aubigné score used at each follow up.

Instruments and implants used to treat acetabular fractures

AO acetabulum instruments



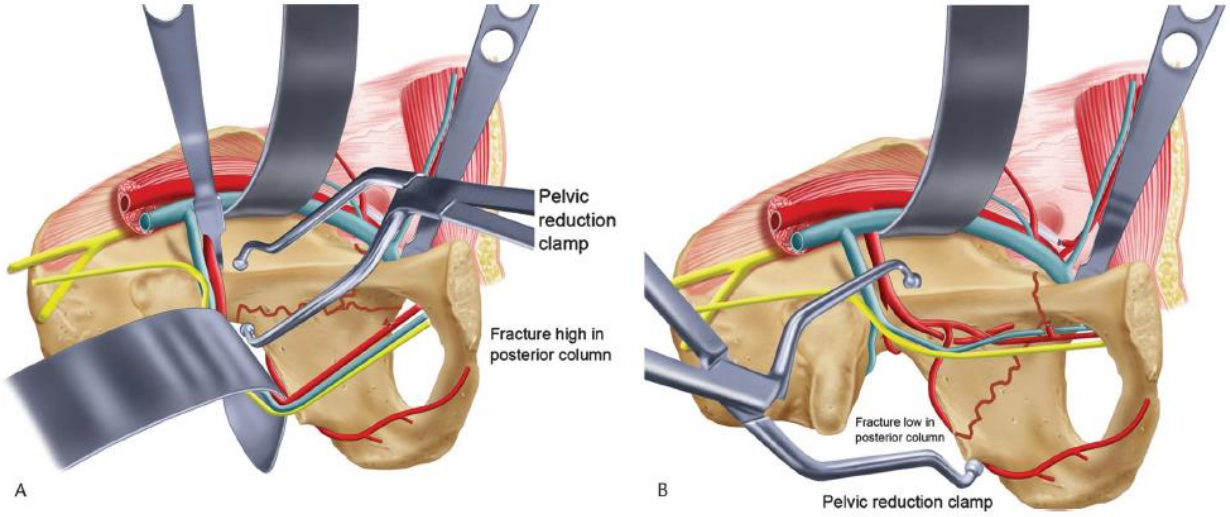


Matta ‘s Quadrangular clamps

Farabeuf clamps

Multipurpose plate bender for recon plate

picador ball spike pusher with pusher



Pict. Illustrating the method of reduction using Farabeuf clamp

MATERIALS AND METHODS

This a prospective and retrospective study to assess functional and radiographic outcome of acetabular fractures fixed by Modified Rives-Stoppa's approach was done at the Institute of Orthopaedics and Traumatology , Madras medical college and Rajiv Gandhi Government general hospital, Chennai from April 2012 - August 2014

Our study consists of 10 cases of acetabular fractures both simple and complex (AO type B & C).Inclusion criteria consists of Age greater than 14 years , less than 70 yrs, Closed fractures, simple fractures like Anterior column, Anterior wall, Transverse fractures, Transverse with posterior wall fracture,T Type fracture, Anterior column or wall with posterior hemitransverse fracture , Both column fractures, fractures less than 3 weeks old.

Open injuries, fracture greater than 3 weeks old, age less than 14 yrs and more than 70 yrs were excluded from this study and also not encountered.

In our study after general resuscitation of the patients, a detailed clinical examination and radiological assessment was done.

Patients were put on lower femoral pin traction.

The Mean age of the patients was 35.45 year ranging from 18 to 60 year.

Age	No of Patients	Percentage
<20 years	1	10%
21-30 years	4	40%
31-40 years	1	10%
41-50 years	2	20%
51-60 years	2	20%

Sex Incidence:

Sex	Numbers	Percentage
Male	8	80%
Female	2	20%

Males dominate in our study in 8:2 ratio

Mode of Injury: Majority of the patients suffered Road Traffic Accidents followed by Fall from Height.

Mode of injury	No. of Patients	Percentage
RTA	8	80%
Fall from Height	2	20%

Fracture distribution:

Fracture type (Judet and Letournal)	No. of Patients	Percentage
Transverse	1	10%
T type	2	20%
Anterior column with posterior hemitransverse	4	40%
Both column	2	20%
Anterior wall	1	10%

Side of injury:

Side	No	Percentage
Right	4	40%
Left	6	60%

Associated Injuries:

In our study 8 patients had associated injuries.

Associated injuries	No. of Patients
Distal radius fracture	1
Bladder injury	1
Sacroiliac joint disruption	1
Fracture of Inferior pubic rami	2

Surgical Approaches:

Procedure	No. of Patients
Modified Rives-Stoppa's approach followed by Kocher-Langenbeck Approach	2
Modified Rives-Stoppa's approach converted into Ilioinguinal approach	1
Modified Rives-Stoppa's approach	7

Functional Outcome:

Modified Merle'd Aubinge And Postel Grading System:

CLINICAL GRADING SYSTEM

Pain

None	- 6
Slight or intermittent	- 5
After walking but resolves	- 4
Moderately severe but patient is able to walk	- 3
Severe, prevents walking	- 2

Walking

Normal	- 6
No cane but slight limp	- 5
Long distance with cane or crutch	- 4
Limited even with support	- 3
Very limited	- 2
Unable to walk	- 1

Range of motion*

95-100%	- 6
80-94%	- 5
70-79%	- 4
60-69%	- 3
50-59%	- 2
<50%	- 1

Clinical score

Excellent-18

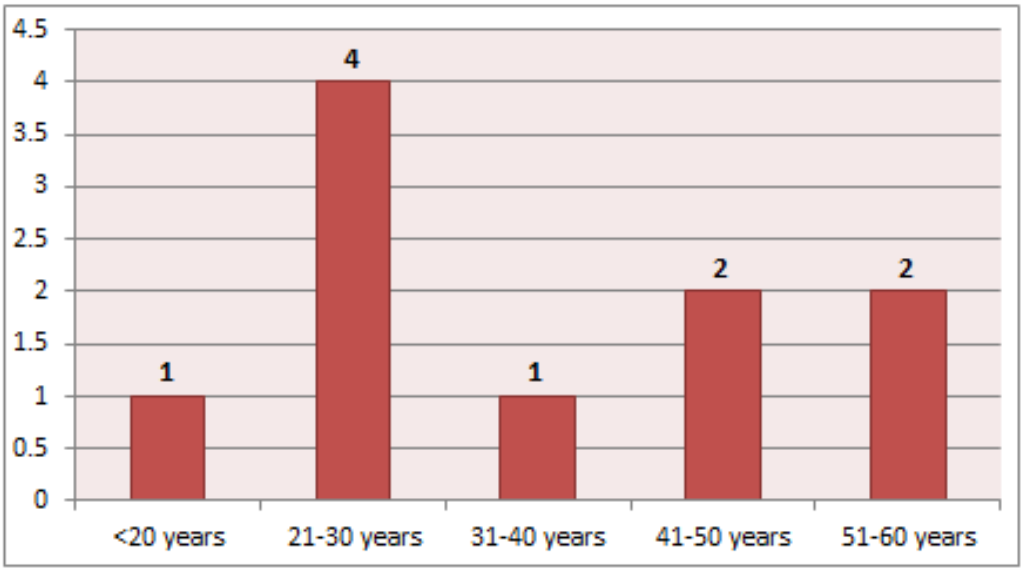
Good-17, 16, 15

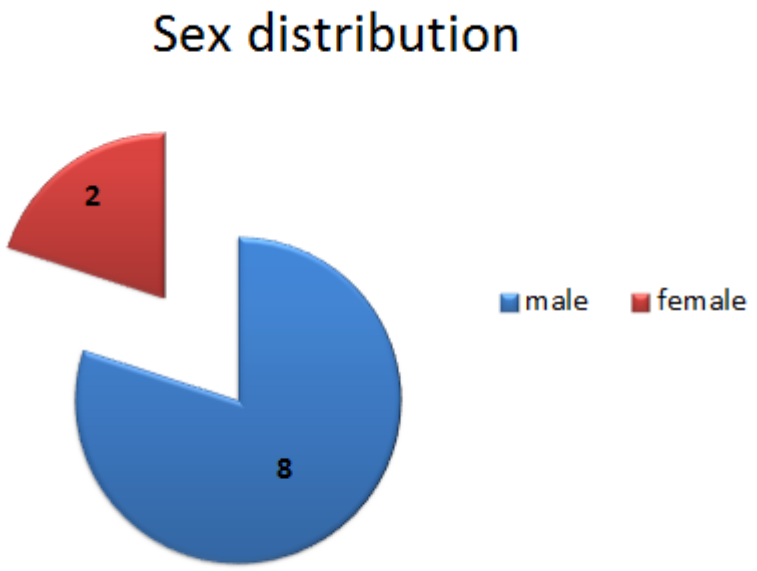
Fair 13 or 14

Poor <13

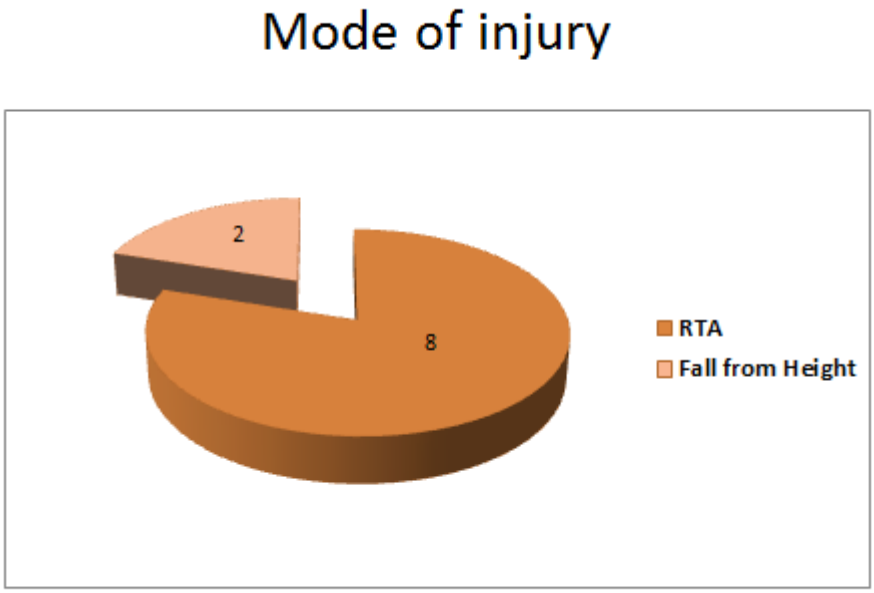
*The range of motion is expressed as the percentage of the value for the normal hip. This is calculated by obtaining a total of the range of movements, in degrees, of flexion-extension, abduction, adduction, external rotation, and internal rotation for the injured hip and dividing it by the total for the normal hip.

Age distribution



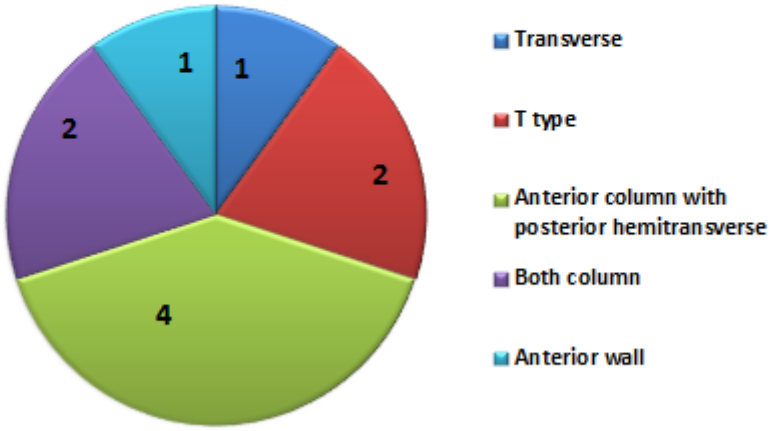

Sex distribution
2
8
male
female

-

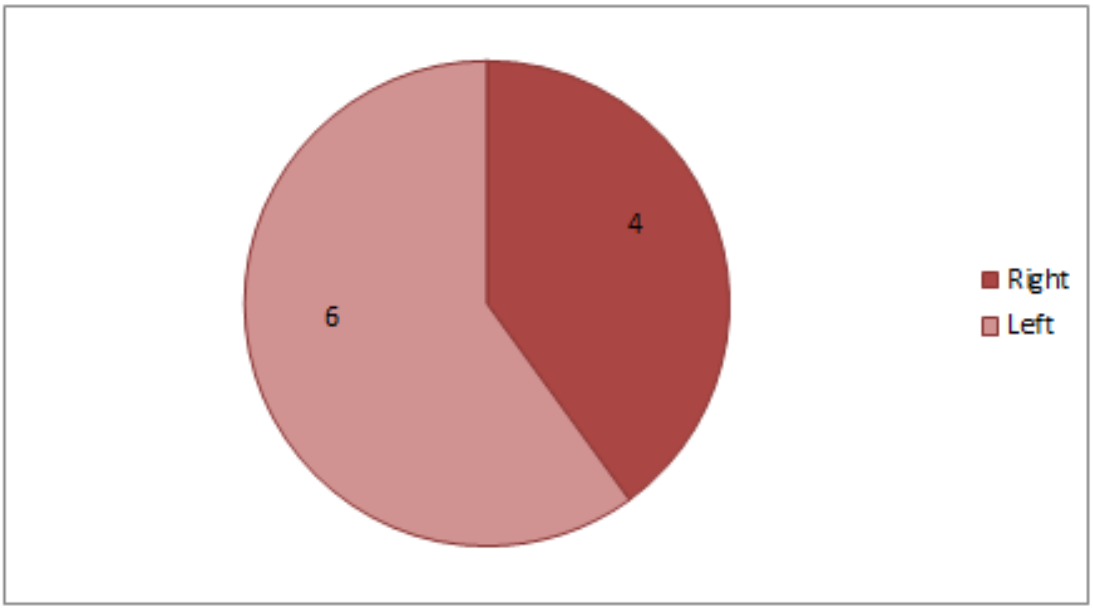

Mode of injury
2
8
RTA
Fall from Height

Fracture distribution

Total no. of case :10



Side of injury



OBSERVATION

Ten patients with acetabular fractures including both simple and complex were treated surgically through anterior approach by Modified Rives-Stoppa's method and analysed with average follow up of 14 months ranging from 6 months to 3 years.

The following observations were made

1. 20% patients belong to 4^{th} decade and 5^{th} decade followed by 50% belong to less than 30 years.
2. Males dominate our study group with a ratio of 8: 2
3. Road traffic accidents form major form of injury in our 80% of patients .
4. Anterior column with posterior hemitransverse fracture is the most common type in our study (4 cases) followed by T type fracture & Both column fracture 2 cases in each.
5. Out of 10 patients 5 patients had associated skeletal injuries. One patient had urethral injury.
6. Two patients were also operated by Kocher-Langenbeck approach.
7. In contrast to pelvic injuries, all patients were hemodynamically stable at the time of admission.

8. In our study the average surgical time delay was 6 days ranging from 4 to 12 days.
9. The average surgical time was 114 minutes ranging from 90 minutes to 3hrs.
10. 4 patients have encountered operative complications.
11. 2 patients had superficial infection settled with antibiotics. One patient developed DVT resolved with heparin. Other patient was found have intraaticular screw.
12. One patient who also operated by posterior Kocher-Langenbeck approach developed sciatic nerve palsy.
13. 1 patient had sacroiliac distruption
14. No patient had Pubic diastasis
15. No patient died during treatment or follow up.
16. According to Merle D'Aubigne score, 30% patients had excellent score with 50% belong to good score.

Results

Ten patients of acetabular fractures both simple and complex were treated surgically and analysed with average follow up of 14 months (6 months –3 years). Functional outcome of patients were assessed by Modified Merle d'Aubinge .It was based on Pain, Walking ability and Range of movement. Out of 10 patients,

3 patients had Excellent,

5 patients had Good,

1 patient had Fair and

No poor results were encountered.

Discussion

The treatment of acetabular fractures by Modified Rives-stoppa approach are studied in detail. The options for treatment of complex acetabular fractures are wide and are continuously refined over time. The treatment of complex acetabular fracture is difficult because it involves extensive exposure and reduction cannot be achieved through a single approach.

There are articles on conservative management of complex acetabular fractures treated with lateral and longitudinal skeletal traction[16]. . They highlight that congruent reduction can be achieved by traction[16]. But immobilization and their complications are to be stressed upon.

The highlight of open reduction and internal fixation of fractures is Anatomic reduction, rigid fixation and early mobilization which will keep the joint functional as told by Matta[5]. Pennal et al[18] quoted that, the quality of the clinical result depends directly on the quality of the reduction that was achieved when open reduction and internal fixation were performed. Difficult surgical exposure, delay in surgery, and complications pose great challenge for the surgeons but with experience and care those factors can be addressed.

Management of displaced acetabular fractures need adequate exposure and the approach should produce minimal morbididty. An ideal approach would allow inspection of both columns and the articular surfaces with minimal

complications. Extensile approaches around the hip joint have reported a high complications rate.

Alonso et al. reported 53% incidence of heterotopic ossification with a Triradiate approach and 86% incidence with the use of an extended iliofemoral approach. We used a non-extensile approach for operating in these patients.

Modified Rives-Stoppa's approach is known for their safety and less complications. As this approach by-pass the neurovascular window chances of traction injury to the femoral nerve and femoral vascular bundle become less. Chances of post-operative inguinal hernia complications are less as inguinal canal is not breached. This approach provides a good visualization of quadrilateral surface and posterior column. Only structure that needs to be taken care in this approach was Corona mortis which can be safely dissected and ligated. During our study we have never encountered any bleeding complications regarding corona mortis and in all patients it was isolated and ligated and cauterized. Obturator nerve is another structure which can be encountered while fixing the quadrilateral surface must be identified and preotected

The mean age group in our study was 35.3 years which is comparable with Claude article on complex acetabular fracture. In our study group males predominated since road traffic accident is more common in males, which is comparable in other srudies[2].

A standard antero-posterior and Judet view of the pelvis are the basic investigations to quantify acetabular fractures and CT scan obtained before reduction of the joint are helpful in evaluation and decision making of the injured hip.

Factors[19] influencing the outcome are degree of initial displacement, damage to the superior weight bearing dome or femoral head, degree of hip joint instability caused by posterior wall fracture, adequacy of open or closed reduction and late complications like AVN, heterotopic ossification, chondrolysis or nerve injuries.

We used single approach in all patients except in 2 patients where additional Posterior approach was needed to address the posterior column fracture fixation as it was difficult to address through anterior approach. With this single approach we are able to get satisfactory outcome in 80% of patients in short term.

Swiontkowski[2] reported one case of DVT through anterior approach. In our study also we had one case of DVT. Giannoudis et al[20] reported 8% of iatrogenic sciatic nerve palsy in posterior approaches, Swiontkowski et al[2] also showed 8.3 % iatrogenic sciatic nerve palsy in his study, we had one case of sciatic nerve injury during posterior approach. The complication rate is very low when compared to Matta[5], Swiontkowski[2] and Claude[21] studies . No case of heterotopic ossification is encountered till date in our study.Heterotopic

ossification was reported as high as 20% in extensile approaches used for complex fractures .We have used [15]Indomethacin for patients for 6 weeks as prophylaxis for heterotopic ossification. Avascular necrosis of femoral head was reported in literatutre . In our study we had not encountered that complication. We had a case of intra articular screw penetration in anterior approach but patient was asymptomatic and clinically patient showed excellent outcome.

The non-extensile approache which we addressed in our study has less operating times and average blood loss which are similar to those reported by others (Matta et al ı986; Goulet and Bray 1988; Reinert et al 1988; Routt and Swiontkowski 1990; Helfet et al 1992).

Anterior column with posterior hemitransverse fracture (no of patients =3)

Out of 3 patients with Anterior column and posterior hemitransverse, 2 patients (66%) had Excellent outcome and 1 patient (33%) had fair outcome.

For these 2 patients who had excellent outcome, both columns were fixed using the single approach. Lateral window was also used for these 2 patients.

The patient who had fair clinical outcome was operated using both Modified Rives-Stoppa & Posterior approach(Kocher –Langenbeck) on separate days. Because the posterior column fracture pattern was comminuted and difficult to address anteriorly we operated through posterior approach 5 days after completing the anterior approach. This patient also developed sciatic nerve injury in the form of foot drop which improved in the 1 year follow up period.

Both column fracture (no of patients =2)

Out of two patients with both column fractures, 1 patient had excellent Clinical outcome and 1 patient had good clinical outcome in a 1 year follow up period.

The 1 patient who had fair clinical outcome was operated 2 weeks after injury. This patient also developed Deep Vein Thrombosis after 1 month follow up which resolved after taking medications for DVT.

T- Type fracture (no of patients =2)

Clinical outcome after 6 month follow up was good 1(50%) and fair in 1(50%)

The results of operative treatment of acetabular fractures are influenced by numerous factors, including the type of fracture and/or dislocation, damage to

the femoral head, associated injuries, and timing of the operation, quality of reduction, local complications, and the surgical approach.

We had only a small study group of 10 patients and analysed the functional outcome. We were able to produce satisfactory result with this approach with fewer complications. Complication may be less due to short period of follow up.

Conclusion

In our short term study, we were able to produce satisfactory results with minimum complications in this new upcoming approach which is being widely practised throughout the world from 2010. Use of non extensile approaches have made surgery simple and reduced the complications. With improvement in surgical experience and earlier surgical intervention, we can produce better results in this new approach for anterior exposure of the acetabulum to treat complex acetabular fractures.

Advantages of this approach:

- We can avoid neurovascular complications by this new approach
- Quadrilateral surfaces can be addressed easily as the facture appears perpendicular to the plane of this approach.
- Chances of better wound healing and avoidance of long scars
- Less chance of Heterotopic ossifications
- Chances of Inguinal hernia are less as inguinal canal is not breached in this approach
-

Disadvantages noted in this approach:

- Articular surfaces cannot be visualized
- Certain comminuted anterior wall fractures will be difficult to deal in this approach

As told by Matta, every chance of reducing the fragments anatomically, fixing rigidly and mobilizing early must be done for better function. This can’t be achieved by conservative means added to complications of immobilization. Anatomic restoration of joint will enable the patient to have a better quality of life and makes it easy for future reconstructive procedures in case of late complications.

Case illustrations

Case 1

NAME	:	DHANASEKARAN
IP NO	:	12292
AGE/SEX	:	40yrs/M
OCCUPATION	:	Electrician
DIAGNOSIS	:	Anterior column with posterior hemitransverse acetabulum left hip
ASSOCIATED INJURIES	:	Nil
PROCEDURE DONE	:	ORIF with recon plate
SECONDARY PROCEDURE	:	Nil
COMPLICATIONS	:	Nil
TIME DELAY IN SURGERY	:	5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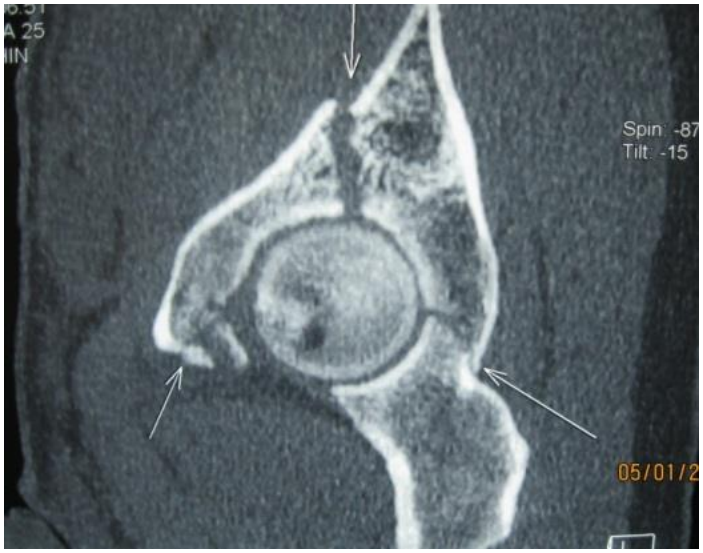
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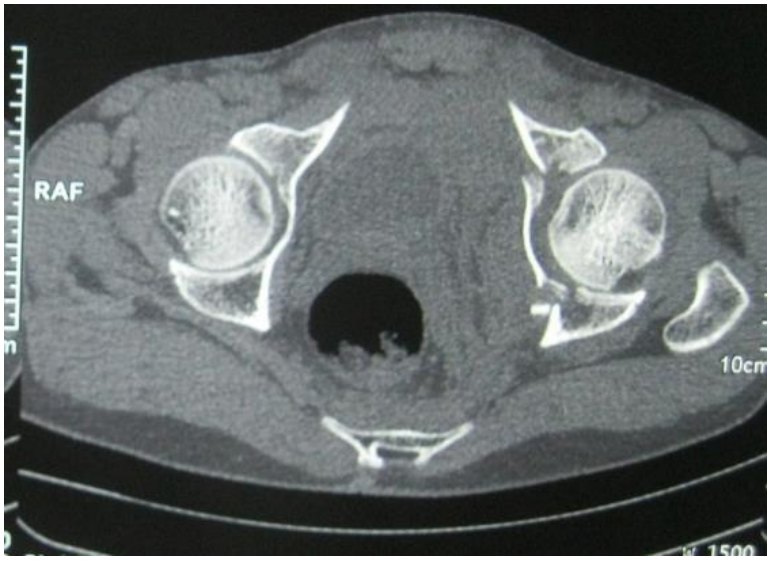
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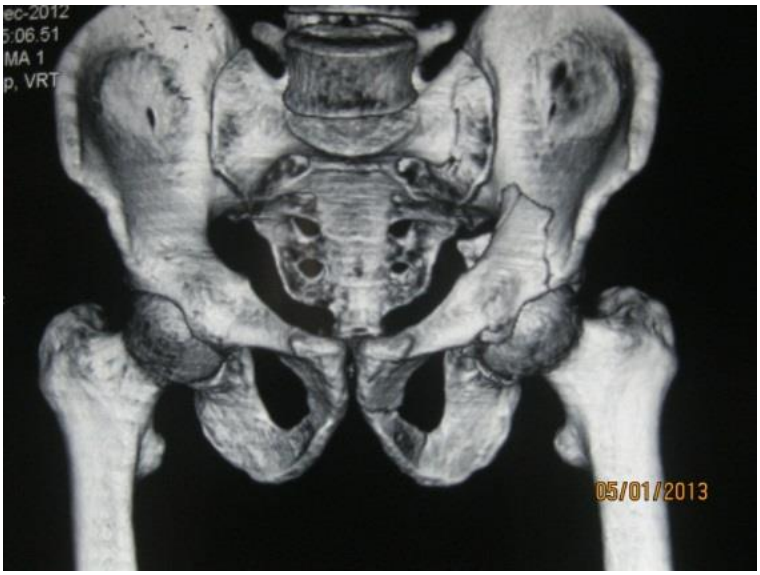
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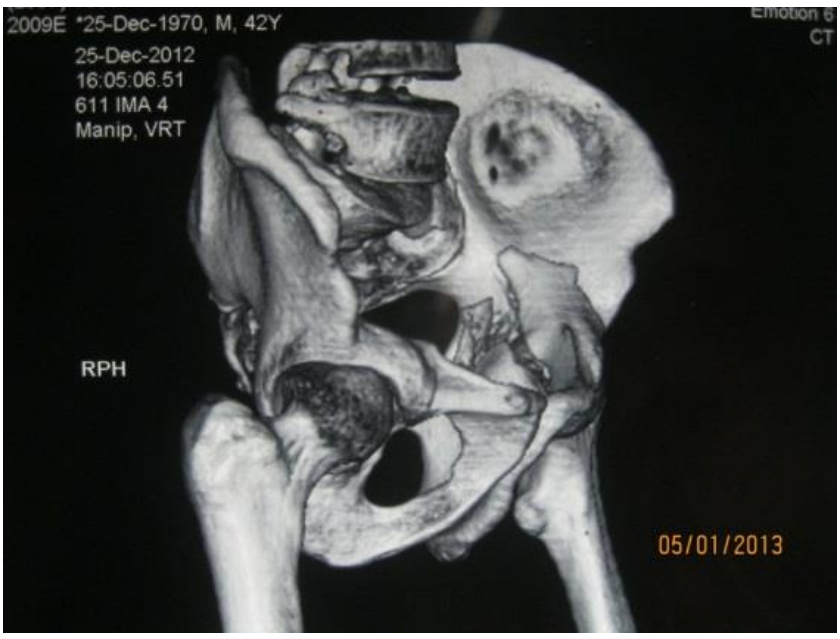
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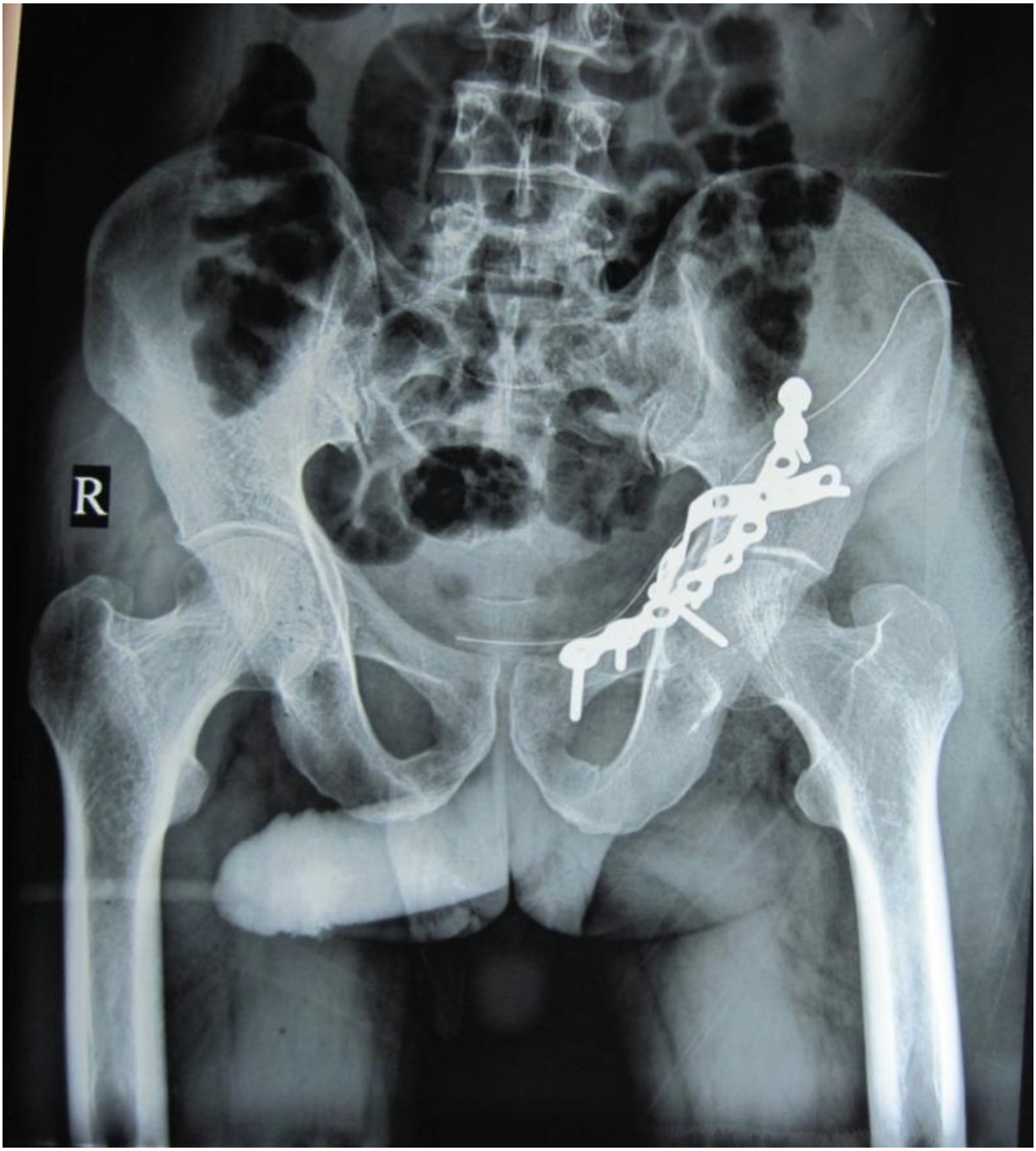
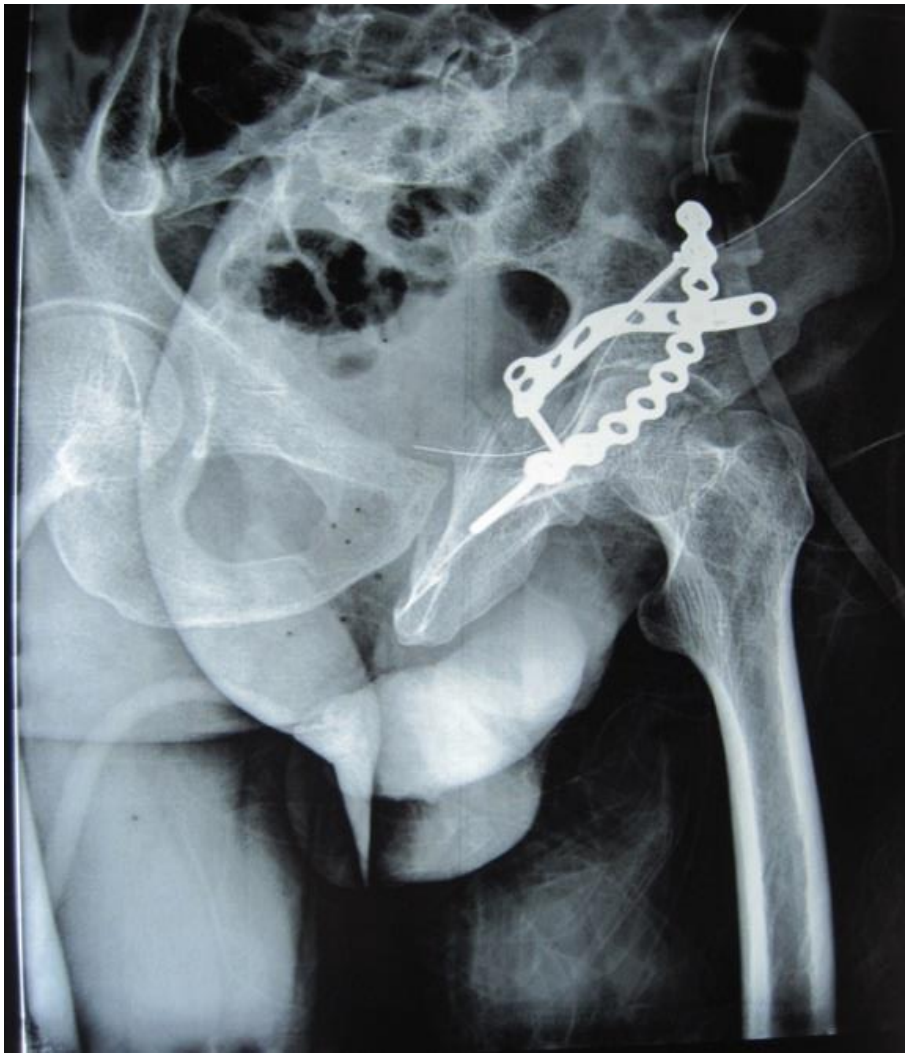
Immediate post op x rays





2 yr follow up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Case 2

NAME	:	ELUMALAI
IP NO	:	64244
AGE/SEX	:	20yr/M
OCCUPATION	:	Driver
DIAGNOSIS	:	Anterior column with posterior hemitransverse acetabulum(Lt)
ASSOCIATED INJURIES	:	Nil
PROCEDURE DONE	:	ORIF with recon plate
SECONDARY PROCEDURE	:	Posterior column fixation by posterior approach
COMPLICATIONS	:	Sciatic nerve injury
TIME DELAY IN SURGERY	:	5

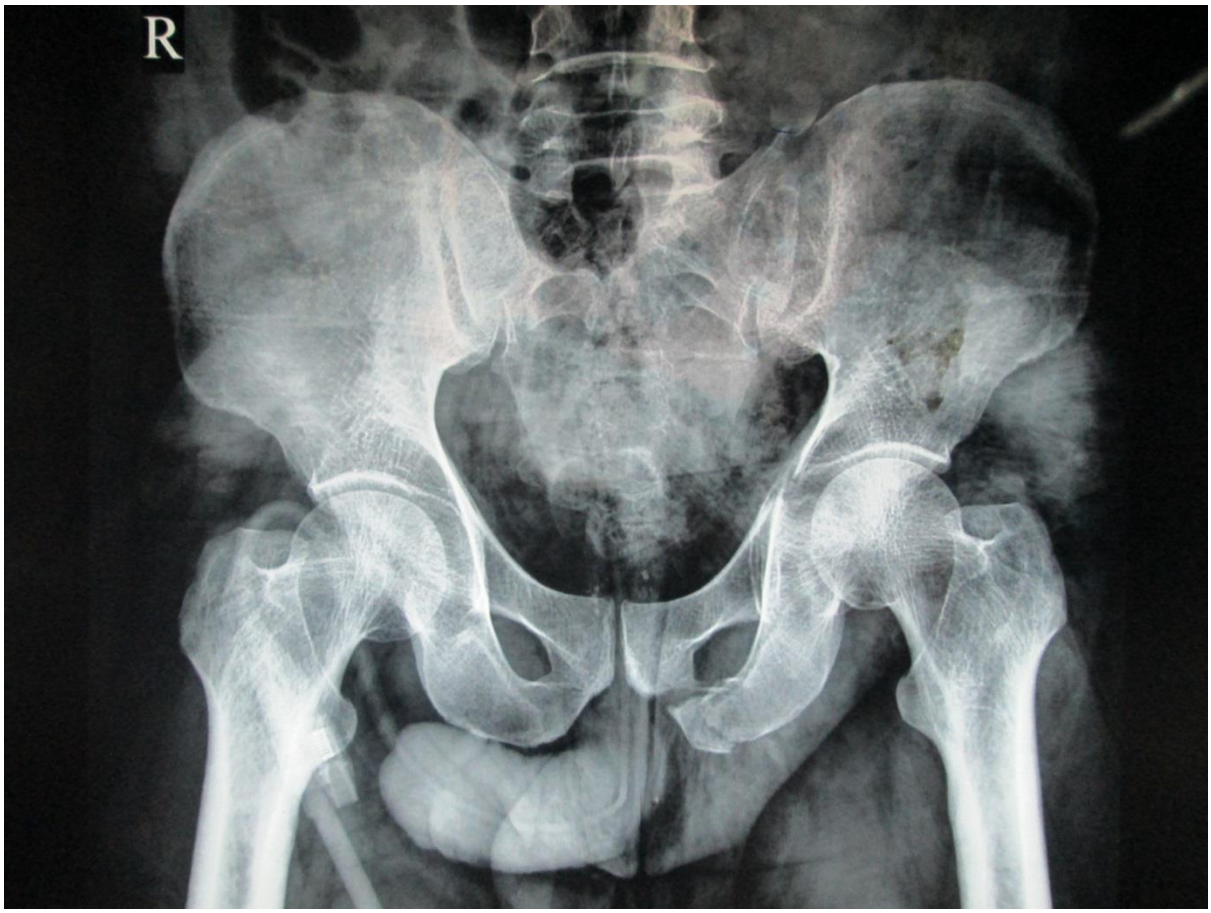
Pre op X rays

Immediate Post op X rays

1 year follow up

Case 3

NAME	:	RAMADOSS
IP NO	:	16978
AGE/SEX	:	60yrs/M
OCCUPATION	:	Farmer
DIAGNOSIS	:	Anterior column with posterior hemitransverse acetabulum(left)
ASSOCIATED INJURIES	:	Sacroiliac joint Disruption
PROCEDURE DONE	:	ORIF with recon plate, SI screw
SECONDARY PROCEDURE	:	
COMPLICATIONS	:	DVT
TIME DELAY IN SURGERY	:	5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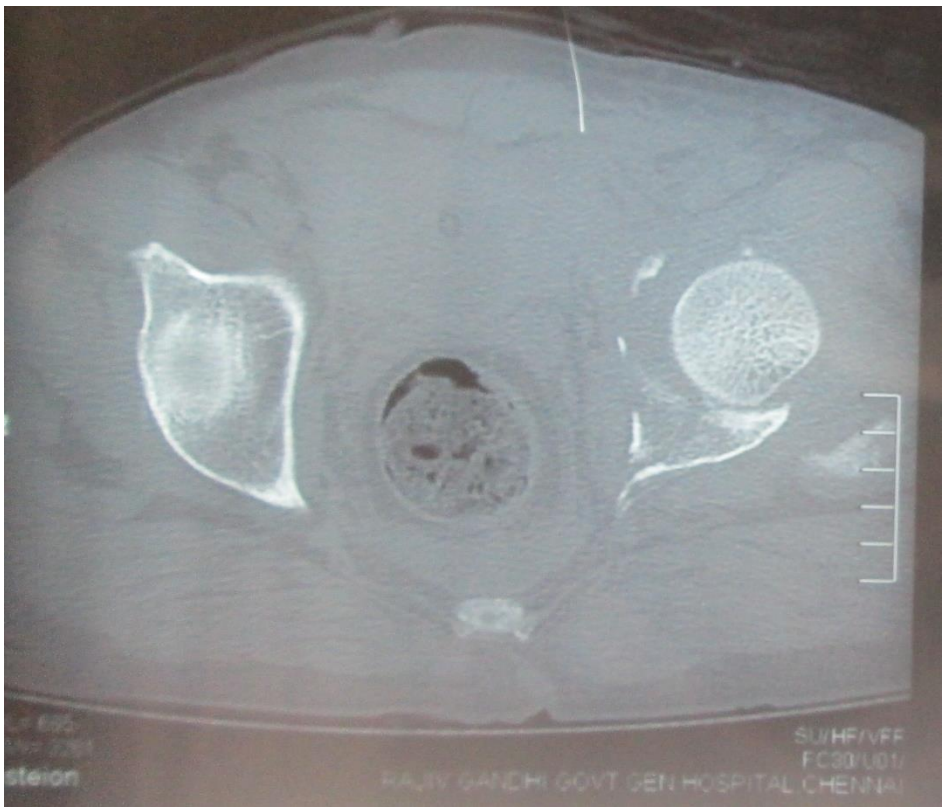
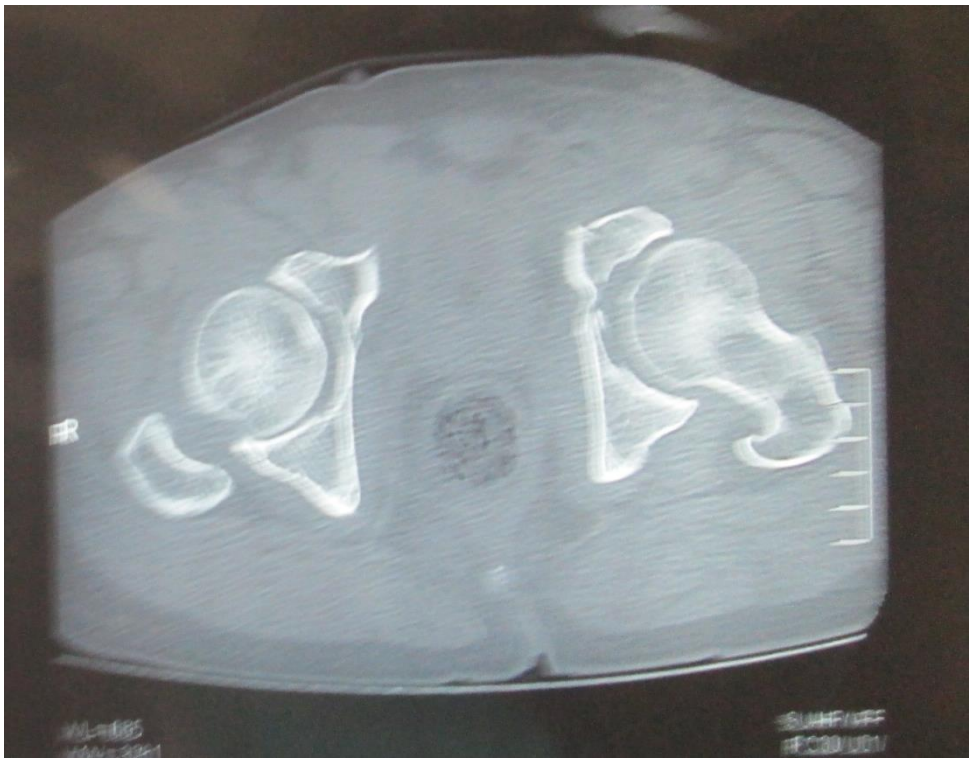
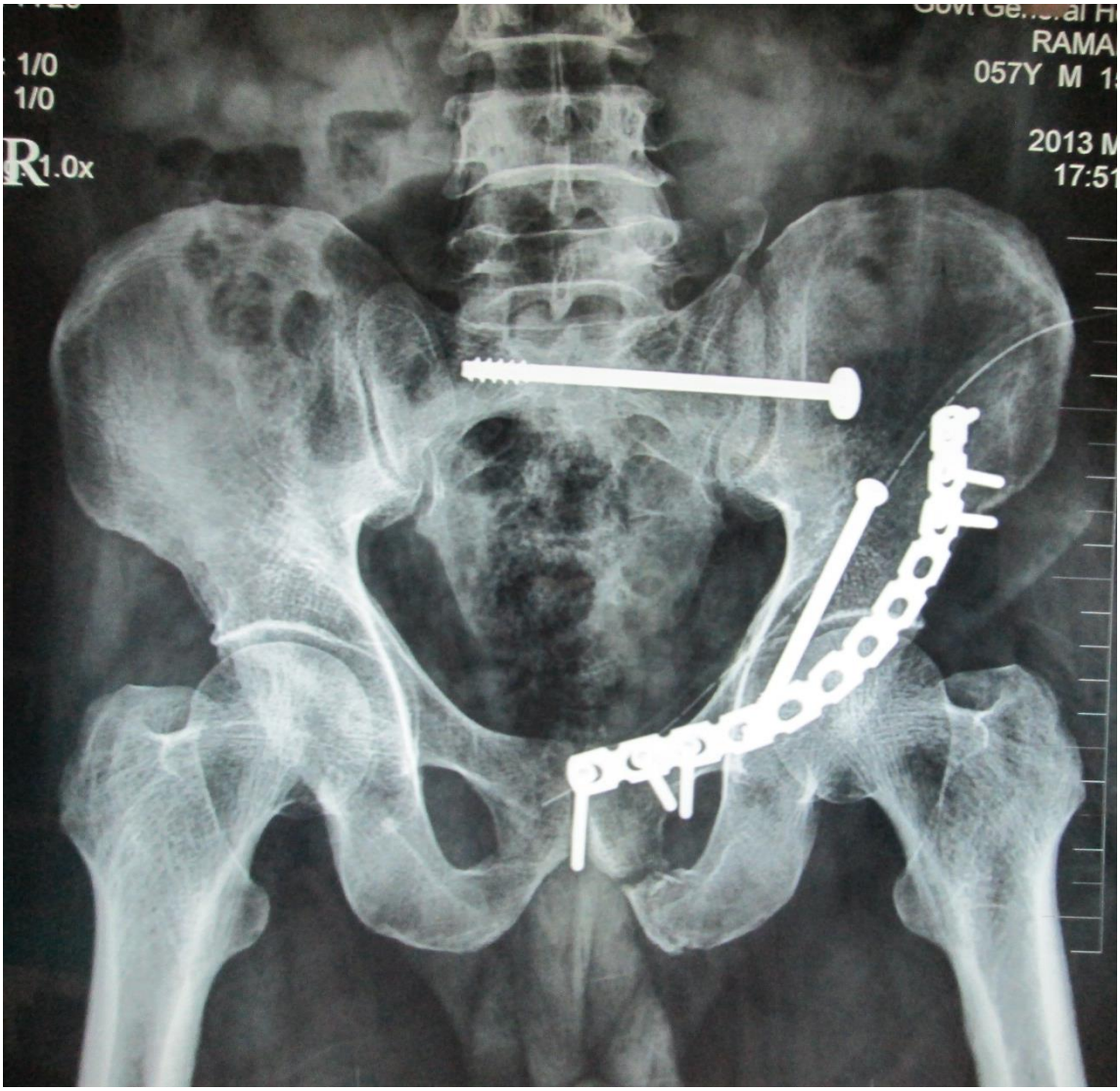

RAJIV GANDHI GOVT GEN HOSPITAL CHENNAI



Immediate Post op

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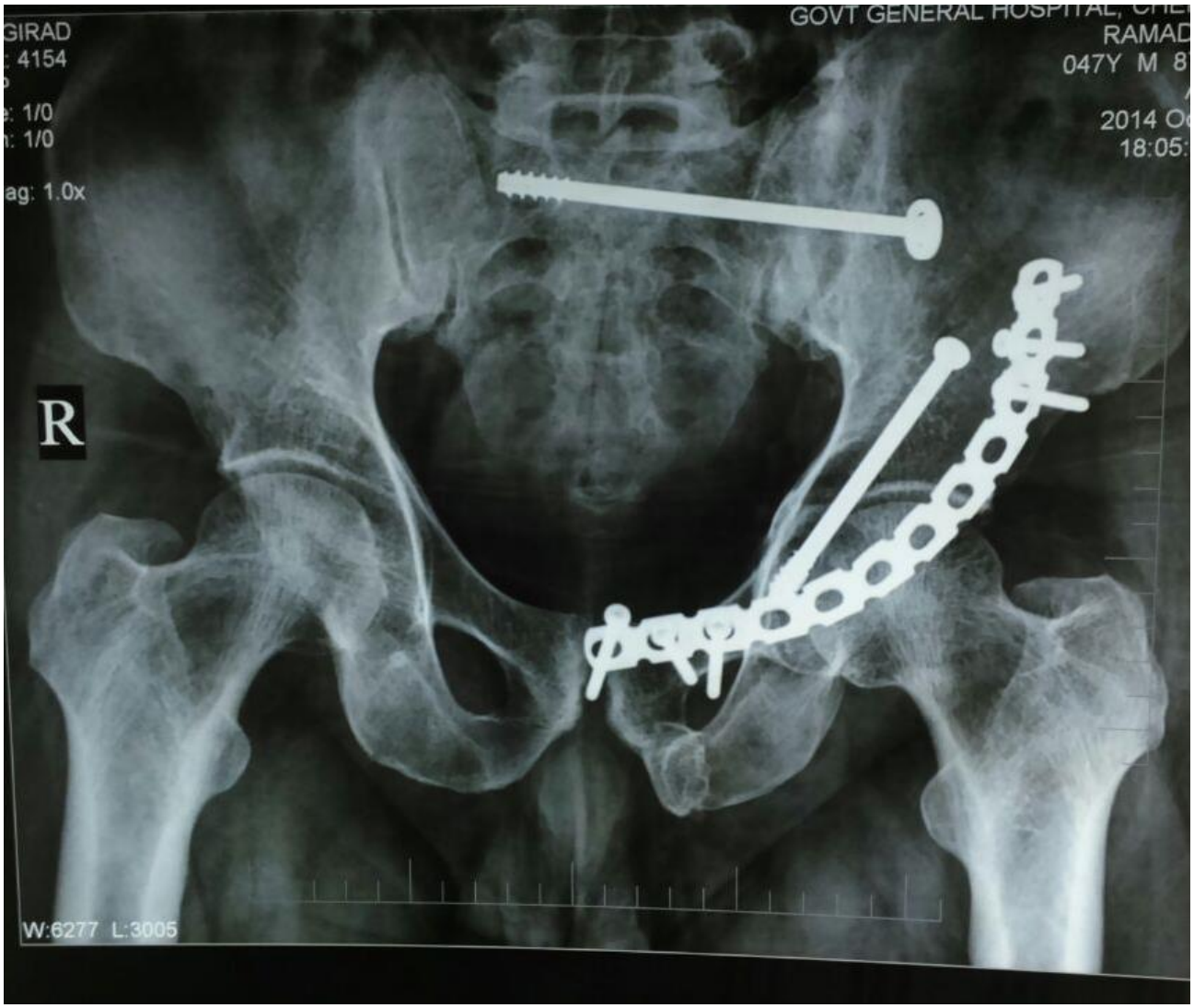
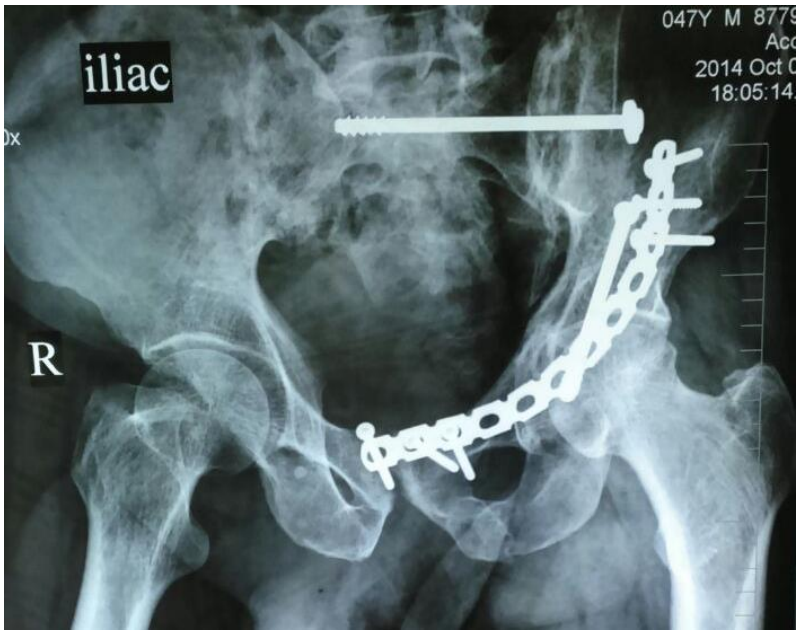
5492 L:2630


L:2667

1 ½ year follow up



1 ½ year follow up



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21)The Anterior Intra-Pelvic (Modified Rives-Stoppa)

H. Claude Sagi, MD, Alan Afsari, MD,† and Daniel Dziadosz, MD**

S. No	Name & IP No	Age years	Sex	Date of Admisssion	Mode Of injury	Diagnosis	Asso. Injuries	Date Of surgery	Time Delay In days	Procedure	Surgical time	Complications	Follow Up	Outcome Total=18	Result
1	Manikandan 83384	32	M	7.12.10	FALL	Both column fracture acetabulum Rt	Distal radius #, Urethral injury	14.12.10	7	ORIF Via Modified Rives-Stoppa approach	90 min	Nil	3 years	15	Good
2	Sitandar 6246	28	M	17.3.12	RTA	Transverse # Lt	Nil	22.3.12	5	ORIF Via Modified Rives-Stoppa approach	90 min	Intra articular screw	6 mon	17	Good
3	Padmavathy 67855	22	F	22.7.12	RTA	Both column fracture acetabulum Rt	Nil	28.7.12	5	ORIF Via Modified Rives-Stoppa approach	100 min	Nil	1 year	18	Excel lent
4	Dhanasekaran 122292	42	M	26.12.12	FALL	Anterior column fracture with posterior hemitransverse Lt	Nil	31.12.12	4	ORIF Via Modified Rives-Stoppa approach	90	Nil	2	18	Excel lent
5	Ramadoss 16978	60	M	20.2.13	RTA	Anterior column fracture with posterior hemitransverse Lt	Sacroiliac joint disruption Lt	4.3.13	11	ORIF Via Modified Rives-Stoppa approach	180 min	DVT	1 year	18	Excel lent
6	Elumalai 64244	20	M	10.7.13	RTA	Anterior column with posterior hemitransverse# Lt	Rt SPR & IPR #	18.7.13	5	ORIF Via Modified Rives-Stoppa approach	100 min	Sciatic nerve palsy	1 year	14	Fair

										followed by kocher langenbeck					
7	Premkumar 10850	29	M	13.12.13	RTA	T type fracture acetabulum Rt	Nil	18.12.13	4	ORIF Via Modified Rives-Stoppa approach followed by kocher langenbeck	120 min	Nil	8 months	17	Good
8	Suresh 54244	27	M	14.6.13	RTA	Anterior column fracture acetabulum Rt	Lt SPR and IPR #	20.6.13	5	ORIF Via Modified Rives-Stoppa approach	90	Infection	8 months	16	good
9	Govindammal 13637	50	F	09.02.14	RTA	Anterior wall fracture with quadrilateral plate # Lt	GIIIB compound # BB Lt leg	22.02.14	12	ORIF Via Modified Rives-Stoppa approach	180 min	Nil	6 months	13	fair
10	Nandeshwaran 86180	43	M	5.3.14	RTA	T Type # acetabulum Lt	Nil	10.3.14	5	ORIF Via Modified Rives-Stoppa approach	100 min	Nil	6months	15	Good

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No : 044 25305301
Fax: 044 25363970

CERTIFICATE OF APPROVAL

To

Dr.M.Suresh Kumar,
Post Graduate MS (Orthoaedics),
Institute of Orthopaedics and Traumatology,
Madras Medical College,
Chennai – 600 003.

Dear **Dr.M.Suresh Kumar,**

The Institutional Ethics Committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled **"Prospective and Retrospective Study on Analysis of Clinical outcome of acetabular fractures treated through Modified Rives – Stoppa's approach"** No. 27072014.

The following members of Ethics Committee were present in the meeting held on 03.06.2014 conducted at Madras Medical College, Chennai-3.

1.	Dr. C.Rajendran, M.D,	-- Chairperson
2	Dr.R.Vimala, M.D, Dean, MMC, Ch-3	-- Deputy Chairperson
3.	Prof. Kalaiselvi, M.D, Vice Principal, MMC, Ch-3	-- Member Secretary
4.	Prof. Nandhini, M.D, Inst. of Pharmacology, MMC, Ch-3	-- Member
5.	Prof.G.Muralidharan, M.S, Prof & HOD General Surgery, MMC, Ch-3	-- Member
6.	Prof. Md Ali, MD., DM., Prof& HOD of MGE, MMC, Ch- 3	-- Member
7.	Prof. Ramadevi, Director i/c, Biochemistry, MMC, Ch- 3	-- Member
8.	Prof. Sasraswathy, MD., Director, Pathology, MMC, Ch- 3	-- Member
9.	Prof. Tito, Director, i/c. Inst. of Internal Medicine, MMC	-- Member
10.	Thiru.S.Ramesh Kumar, Administrative Officer, MMC, Ch-3.	-- Lay Person
11.	Thiru. S. Govindasamy, BA., BL	-- Lawyer
12.	Tmt.Arnold Saulina, MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

Vice-Principal
Madras Medical College
Chennai-600 003.

PATIENT INFORMATION SHEET

TITLE OF THE STUDY : **ANALYTICAL STUDY ON CLINICAL OUTCOME OF INTERNAL FIXATION OF FRACTURES OF ACETABULUM THROUGH MODIFIED RIVES-STOPPA APPROACH.- RETROSPECTIVE CUM PROSPECTIVE STUDY**

We are conducting a study on **" ANALYTICAL STUDY ON CLINICAL OUTCOME OF INTERNAL FIXATION OF FRACTURES OF ACETABULUM THROUGH MODIFIED RIVES-STOPPA APPROACH"** among patients admitted in the Institute of Orthopaedics & Traumatology, Rajiv Gandhi Government General Hospital, Chennai.

The purpose of this study is to analyse the clinical outcome of internal fixation of fractures of acetabulum through anterior approaches Modified Rives-Stoppa approach .

We are selecting certain cases based clinical pattern of fracture of acetabulum that need to be treated through anterior approach and if you are found eligible, we perform surgical procedure for the fractured acetabulum by Modified Rives-Stoppa approach or if you are all already operated for the acetabular fracture by the above mentioned approach we will evaluate the outcome of surgery, which in any way do not affect your final report or management.

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication o r presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator Signature of Participant

Date :

PATIENT CONSENT FORM

Study Detail : **ANALYTICAL STUDY ON CLINICAL OUTCOME OF INTERNAL FIXATION OF FRACTURES OF ACETABULUM THROUGH MODIFIED RIVES-STOPPA APPROACH .- RETROSPECTIVE CUM PROSPECTIVE STUDY**

Study Centre : RajivGandhiGovernment GeneralHospital, Chennai.

Patient's Name :

Patient's Age :

Identification Number :

Patient may check (√) these boxes

a) I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ☐

b) I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

c) I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

d) I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ☐

e) I hereby consent to participate in this study. ☐

f) I hereby give permission to undergo detailed clinical examination, Radiographs ,blood investigations and surgical procedure as required. ☐

Signature/thumb impression Signature of Investigator

Patient's Name and Address: Study Investigator's Name: **Dr. M.Suresh Kumar**

ஆய்வு தகவல் தாள்

ஆராய்ச்சியாளர் பெயர்: மா.சுரேஷ்குமார்

தலைப்பு: அசிடாபுளம் எலும்பு முறிவுக்கு தகடு வைத்து அறுவை சிகிச்சை மேற்கொண்டு செயல்பாட்டு விளைவினை அளவிடும் மருத்துவ ஆய்வு.

சென்னை அரசு பொது மருத்துவனையில் முழங்கால் எலும்பு முறிவுக்கு சிகிச்சைக்காக சேர்க்கப்படும் நோயாளிகளில் மேற்கொள்ளப்படும் மருத்துவ ஆய்வு.

இந்த மருத்துவ ஆய்வின் நோக்கம் தற்காலிக முழங்கால் வெளி கம்பி பொருத்துதலுக்கு பின்னர் செய்யப்படும் நிலையான முழங்கால் தவிர்த்த உள்/வெளி கம்பி பொருத்தும் அறுவை சிகிச்சை செய்வதன் மூலம் பெறப்படும் செயல்பாட்டு விளைவினை கண்டறிதல்.ளளள

ஊடு கதிர் நிழற்படம் வைத்து சில குறிப்பிட்ட வகையான முழங்கால் எலும்பு முறிவு கொண்ட நோயாளிகள் மட்டும் ஆய்வுக்கு எடுத்து கொள்ளப்படுசவார்கள். தேரந்தெடுக்கப்பட்ட நோயாளிகள் மயக்க மருந்து நிபுணர் ஒப்புதல் பிறகு அறுவை சிசிச்சைக்கு மேற்க்கொள்ளப்படுவார்கள்.

அறுவை சிகிச்சைக்கு முன் மற்றும் அறுவை சிகிச்சைக்குப் பின் எடுக்கப்படும் ஊடு கதிர் நிழற்படங்கள், ஆராய்ச்சிக்கு பயன்படுத்தப்படும்.

மேலும் அறுவை சிகிச்சைக்குப் பின் 6, 10, 12 வாரகாலங்களில் நோயாளியின் அறுவை சிகிச்சை காயம் மற்றும் ஊடு கதிர் நிழற்படம் எடுக்கப்பட்டு எலும்பு சேர்ந்துவிட்டதா என்றும் கால் செயல்பாட்டு அளவும் ஆராயப்படும்.

மேலும் இதற்கு முன்னால் நடந்த ஆய்வில் எந்த பக்க விளைவுகளும் இல்லை என்று உறுதிப்படுத்தியுள்ளது. முடிவுகளை அல்லது கருத்துக்களை வெளியிடும் பொழுது அல்லது ஆய்வின் பொழுது தங்கள் பெயர், அடையாளரங்கள் வெளியிடப்படமாட்டாது எனபதையும் தெரிவித்துக் எகொள்கிறோம்.

பங்கு பெறுபவர் பெயர் : ஆய்வாளர் பெயர் :

கையொப்பம் : கையொப்பம் :

இடம் : தேதி :

<u>சுய ஒப்புதல் படிவம்</u>

தலைப்பு: அசிடாபுளம் எலும்பு முறிவுக்கு தகடு வைத்து அறுவை சிகிச்சை மேற்கொண்டு செயல்பாட்டு விளைவினை அளவிடும் மருத்துவ ஆய்வு.

பெயர் : தேதி :
வயது : வெளி நோயாளி எண் :
பாலினம் : ஆராய்ச்சி சேர்க்கை எண் :
முகவரி :

நான் ..... இந்த படிவத்தில் உள்ள தகவல்களை படித்தேன். (அல்ல) எனக்கு படித்து காண்பிக்கப்பட்டது. நான் இந்த மருத்துவ ஆராய்ச்சி பற்றி எந்த தயக்கமும் இன்றி தகவல்களை கேட்டு பெற்றுக் கொள்டேன். நான் 18 வயதை கடந்தவர் என்றும், இந்த ஆராய்ச்சியில் முழு சுதந்திரத்துடன் பங்கேற்க சம்மதம் என்றும் தெரிவித்துக்கொள்கிறேன்.

1. நான் இந்த ஒப்புதல் படிவத்தை படித்து இதில் உள்ள தகவல்களை நன்கு புரிந்துகொண்டேன்.
2. எனக்கு இந்த ஒப்புதல் ஆவணம் பற்றி நான்றாக விளக்கப்பட்டது.
3. எனக்கு இந்த ஆய்வின் தன்மையை பற்றி விளக்கப்பட்டது.
4. என்னுடைய உரிமை மற்றும் பொறுப்புகள் ஆராய்ச்சியாளர்களால் விளக்கப்பட்டது.
5. நான் இந்த ஆராய்ச்சியிலிருந்து எந்த நேரமும் பின் வாங்கலாம் என்பதையும், அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் பரிந்து கொண்டேன்.
6. இந்த ஆய்வின் மூலம் பெறப்பட்ட என்னுடைய முடிவுகளை வெளியிட விளம்பரதாரர் கட்டுப்பாட்டு அதிகாரிகள், அரசு அதிகாரிகள், நன்னெறி குழு (IEC)க்களுக்கு அனுமதி அளிக்கிறேன்.
7. என் ஆய்வு விவரங்களை பொதுவாக வெளியிடும் பொழுது என்னை பற்றிய அடையாளங்களை ரகசியமாக வைக்கப்படும் என்பதையும் புரிந்து கொண்டேன்.
8. என் சந்தேகத்திற்கு உரிய பதில்களை திருப்தியுடன் பெற்றுக் கொண்டேன்.
9. நான் இந்த ஆராய்ச்சியில் பங்கு பெற முடிவு செய்திருக்கிறேன்.

எனக்கு இந்த ஆய்வின் போது எழும் சந்தேகங்களை ஆராய்ச்சியாளரிடம் கேட்டு தெரிந்து கொள்ள வேண்டும் என்பதை அறிவேன். நான் இந்த படிவத்தில் கையொப்பம் இடுவதன் மூலம், இந்த ஆய்வை பற்றி எனக்கு நான்றாக விளக்கப்பட்டது எனவும் ஒப்புதல் அளிக்கிறேன். எனக்கு இந்த ஒப்புதல் ஆவணத்தின் நகல் வழங்கப்படும்.

.....	.....	.....
நோயளியின் பெயர்	கையொப்பம்/கைரேகை	தேதி
.....	.....	.....
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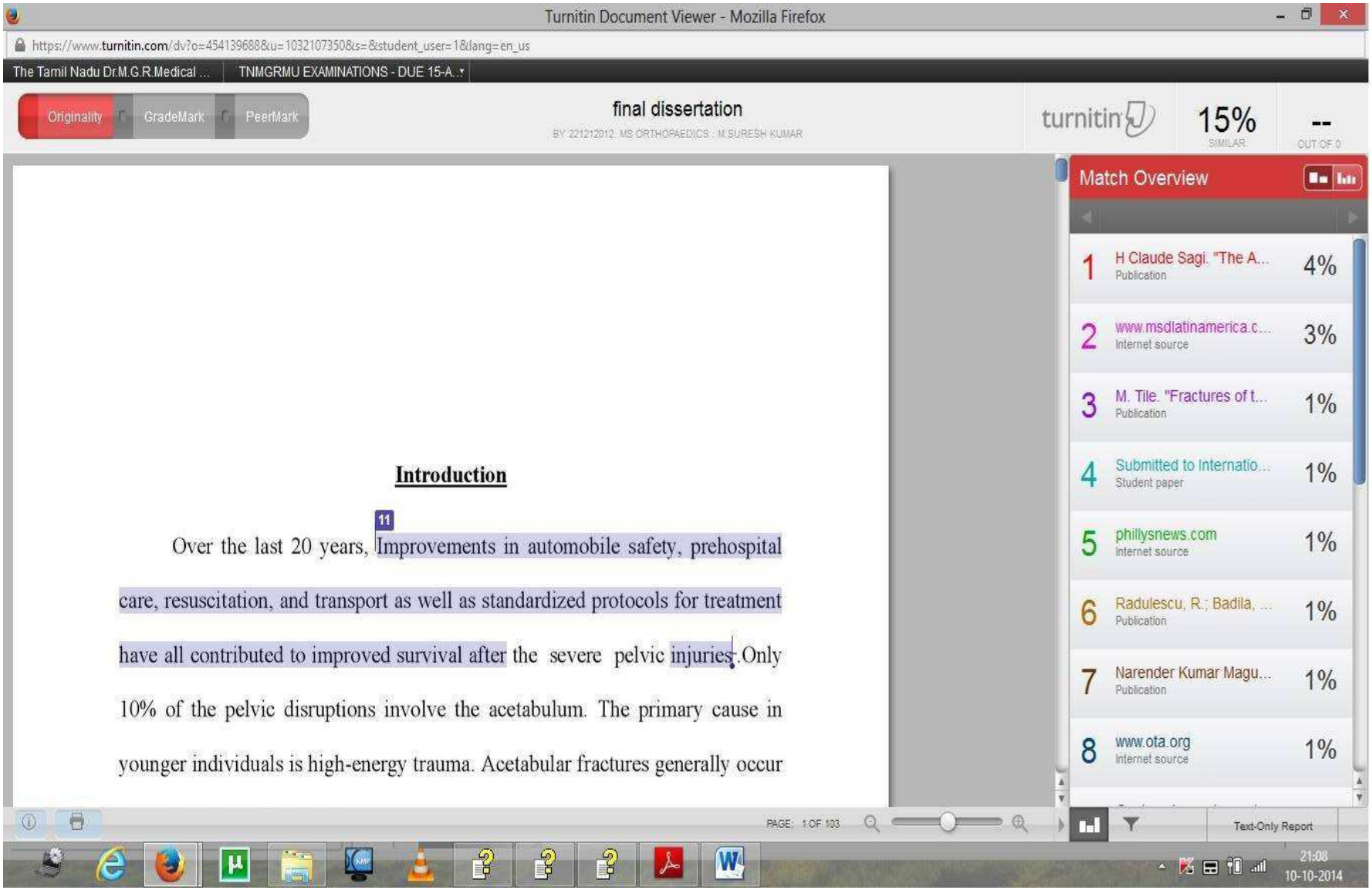
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Over the last 20 years, Improvements in automobile safety, prehospital care, resuscitation, and transport as well as standardized protocols for treatment have all contributed to improved survival after the severe pelvic injuries.Only 10% of the pelvic disruptions involve the acetabulum. The primary cause in younger individuals is high-energy trauma. Acetabular fractures generally occur
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